Project Ref: 2012/Phase 2/Report 01-MPU Draft

PHASE 2 - PLANNING REPORT
DRAFT REHABILITATION PLAN

WAKKERSTROOM
V31A
W42C

November 2012

Environmental Affairs
Water Affairs
Agriculture, Forestry and Fisheries

SANBI
Biodiversity for Life

EXPANDED PUBLIC WORKS PROGRAMME
CONTRIBUTING TO A NATION AT WORK

Aurecon Ref: 6536/107406

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South African National Biodiversity Institute

REHABILITATION PLAN FOR WAKKERSTROOM, W42C, MPUMALANGA

MAIN REPORT

Draft

November 2012

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This report is to be referred to in bibliographies as:

South African National Biodiversity Institute, South Africa. 2012. Draft Rehabilitation Plan. Prepared by Margaret Lowies and Franci Gresse, Aurecon South Africa (Pty) Ltd as part of the planning phase for the Working for Wetlands Rehabilitation Programme. SANBI Report No. 6536/107406

PROJECT DETAILS

TITLE	Rehabilitation Plan for the Working for Wetlands Rehabilitation Programme: Wakkerstroom
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INTERNS	None
CLIENT	South African National Biodiversity Institute (SANBI)
PROJECT NAME	Working for Wetlands Programme~ Draft Rehabilitation Plan Report
REPORT STATUS	Draft
REPORT NUMBER	6536/107406
SUBMISSION DATE	November 2012

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DISCLAIMER

- The intervention points and wetland boundary polygons provided in this report are based on the shapefiles that have been provided by SANBI. The datasets included in the Phase 1 Reports have been updated by the Wetland ecologists and verified by the SANBI Provincial Co-ordinators. All reasonable efforts have therefore been made to ensure that the data is accurate. However Aurecon does not accept responsibility for any remaining inaccuracies in the spatial data provided to us, which may be reflected in this report.
- Aurecon accepts responsibility for the engineering design to the extent that this is based on available information. The available information is limited to what could be interpreted during a single site visit of no longer than a few hours. No geotechnical, topographical, geomorphologic and other engineering related surveys have been undertaken to inform the design. This is non-standard engineering practice and therefore Aurecon is indemnified by the Client and does not accept responsibility for the associated risk of failure from the above limitations or any damages that may occur.
- This Rehabilitation Plan must not be amended without prior consultation and approval from the responsible Aurecon Engineer, SANBI Provincial Coordinator and the SANBI Planning, Evaluation and Monitoring Manager.
- All changes must be motivated using the standard change request form supplemented with additional information as necessary.
- Aurecon is indemnified against any associated damages and accepts no liability associated with the construction and implementation of engineering interventions due to Aurecon being instructed to have limited contact with the implementer during the construction phase resulting in our inability to diligently supervise and assess any progress.
- The Client confirms that by accepting these drawings or reports, he acknowledges and accepts the above mentioned limitation of Aurecon's liability.

ASSUMPTIONS AND LIMITATIONS

In compiling this report, the following has been assumed:

- The information provided in this report is based on site visits that have been undertaken by the project team (Environmental Assessment Practitioner (EAP), Engineer, Wetland Ecologist, and SANBI Provincial Coordinators (PC)) and their subsequent input into the Reporting, which includes intervention design drawings, the wetland assessment, in addition

to input from SANBI's PC. It is understood that this information is sufficient for the authorisation processes and associated Phase 3 (Implementation phase). This data and relevant information has informed the findings and conclusions of this report.

- The level of planning carried out for each project area was dependant on the information contained in the final Phase 1 reports (2011), and in some cases, previously prepared Rehabilitation Plans (2012); along with the Phase 2 site visits that were undertaken during 2012. This document should therefore be read in conjunction with any existing, project-related reports (i.e. draft Phase 1 or previous rehabilitation plans).
- Information contained in this Report will be used during Phase 3 to guide and inform the Implementing Agents on design and construction specifications as part of Phase 3. Implementing Agents will thus use this Rehabilitation Plan and the information contained therein when constructing all interventions, the designs of which have been included in this Report.
- SANBI's Provincial Coordinators will be undertaking the landowner engagement and have obtained the requisite landowner consent forms required as part of Phase 1 and 2 of this project. These include:
  - WW(0): Standard operating procedure,
  - WW(1): Wetland survey and Inspection consent,
  - WW(2): Terms and Conditions for carrying out wetland rehabilitation,
  - WW(3): Wetland Rehabilitation Activities Consent, and
  - WW(4): Property Inspection Prior to Wetland Rehabilitation.
- SANBI have provided all relevant information and documentation required to compile this Rehabilitation Report and the associated Basic Assessment Report.
- Rehabilitation activities should not be carried out until the final Wetland Rehabilitation Plan has been approved and formally signed off by SANBI.
- The implementation of this rehabilitation plan must take into account all relevant provisions of Working for Wetlands Best Management Practices and Construction Environmental Management Plan, the recommendations of the Basic Assessments submitted for Environmental Authorisation and the requirements of the Environmental Authorisation (EA) for the project.
- DEA's prerequisite to increase the requirement of percentage of funding to be spent on labour within the Working for Wetlands (WfWet) programme, has been taken into consideration by the project team during the planning process for wetland rehabilitation.
- Due to the dynamic nature of site conditions and associated biophysical changes within wetlands, this wetland rehabilitation plan is only valid for the 2013/14 financial year. Where appropriate interventions that have not been previously implemented or included in the 2009/10, 2010/11,

2011/12 and 2012/2013 Project Implementation Plans (PIPs) were reviewed and where necessary re-designed for inclusion into the 2013/14 wetland rehabilitation plan. This wetland rehabilitation plan therefore supersedes all previous plans for this project and only interventions from this plan should be included in the 2013/14 PIP.

- Should it be necessary to exclude interventions from the rehabilitation plan, the prioritisation of interventions across the project should strictly be followed.

GAPS IN KNOWLEDGE

- The information in this Report is based on existing available information and input from SANBI's PC, the specialist Wetland ecologists, the Engineer, EAP as well as comments from Interested and Affected Parties (I&Aps). Until this Draft Report has been finalised and signed off by SANBI, the content of the Report should be considered as preliminary.
- Designs for the rehabilitation interventions have been developed for site conditions as at the time of the planning site visits. Should site conditions change before the designs are implemented, changes to the design may be necessary. In this case, project implementers may require the assistance of a professional engineer.
- The cost of construction at each project location will vary due to factors such as the local cost and availability of material, transport distances etc. The unit costs have been agreed with SANBI's PCs based on their knowledge of past projects and include an allowance for escalation.
- The labour intensive targets identified in this project are based on assumed productivity rates for various components of the construction process. This will vary in practise and will require regular monitoring to ensure that labour targets are attained.

Aurecon acknowledges the authorship of any information contained in this document from previous planning years, to the previous provider: Land Resources International (LRI).

This Report must be read in conjunction with the following reports for this project:

1. Final Phase 1 Report – August 2010; and
2. Other Phase 2 Planning Reports which include the:
    a. Basic Assessment Report,
    b. Wakkerstroom Rehabilitation Plan (February 2012), and the
    c. Wetland Assessment (**Appendix A** of this report).

DISTRIBUTION LIST:

		FOR ACTION	**FOR INFORMATION**	**RECEIVED PRIOR TO RELEASE**
John Dini	Director: Freshwater Programme		✓	
Umesh Bahadur	Manager: Planning, Monitoring and Evaluation		✓	
Eric Munzhedzi	Implementation Manager		✓	
André Beetge	SANBI Provincial coordinator	✓		✓
National stakeholders				
Refer to **Appendix G** below			✓(email notification)	
Provincial stakeholders & I&APs				
Refer to **Appendix H** below.			✓(email notification)	

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Context of the information contained in this Rehabilitation plan in terms of the NEMA information requirements for BARs

The environmental assessment process undertaken to date has culminated in the production of a Draft Basic Assessment Report (BAR) and associated draft rehabilitation plans, which provide detailed information relevant to the projects in the Western Cape Province.

In order to guide and focus the reader, the Table below indicates where in the Draft Phase 2 reports (the BAR and/ or the Draft Rehabilitation Plan) the requisite information as outlined in NEMA can be found:

Table 1: Context of report in terms of NEMA requirements

REGULATION	CONTENT AS REQUIRED BY NEMA	SECTION /ANNEXURE
22(2) (a)	(i) Details of the EAP who prepared the report; and	***Introduction of the Draft Mpumalanga BAR***
	(ii) Details of the expertise of the EAP to carry out basic assessment procedures;	***Introduction of the Draft Mpumalanga BAR***
22(2) (b)	A description of the proposed activity;	***Section B Draft Mpumalanga BAR; Draft Wakkerstroom Rehabilitation Plan***
22(2) I	A description and a map of the property on which the activity is to be undertaken and the location of the activity on the property,	***Draft Wakkerstroom Rehabilitation Plan***
22(2) (d)	A description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	***Draft Wakkerstroom Rehabilitation Plan***
22(2) I	An identification of all legislation and guidelines that have been considered in the preparation of the basic assessment report;	***Section B of the Draft Mpumalanga BAR***
22(2) (f)	Details of the public participation process conducted in terms of regulation 21(a) in connection with the application, including –	***Section D of the Draft Mpumalanga BAR***
	(i) The steps that were taken to notify potentially interested and affected parties of the proposed application;	***Section D of the Draft Mpumalanga BAR***

	(ii) Proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given;	***Appendix E of the Draft Mpumalanga BAR***
	(iii) A list of all persons, organisations and organs of state that were registered in terms of Regulation 55as interested and affected parties in relation to the application;	***Appendix E of the Draft Mpumalanga BAR***
	(iv) A summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;	***Appendix E of the Draft Mpumalanga BAR***
22(2) (g)	A description of the need and desirability of the proposed activity	***Executive summary*** ***Section B of Draft Mpumalanga BAR***
22 (2) (h)	A description of identified alternatives to the proposed activity that are feasible and reasonable, including advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity;	***Executive summary*** ***Section B of Draft Mpumalanga BAR***
22(2) (i)	A description and assessment of the significance of any environmental impacts, including cumulative impacts, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the activity;	***Section E of the Draft Mpumalanga BAR***
22(2) (j)	Any environmental management and mitigation measures proposed by the EAP;	***Section E of the Draft Mpumalanga BAR***
22(2) (k)	Any inputs made by specialists to the extent that may be necessary; and	***Wetland assessments attached to the Draft Wakkerstroom Rehabilitation Plan***
22 (2) (l)	a draft environmental management programme containing the aspects contemplated in regulation **33**	***Appendix G of the Draft Mpumalanga BAR***
22 (2) (m)	a description of any assumptions, uncertainties and gaps in knowledge	***Context of BAR, Draft Mpumalanga BAR***
22 (2) (n)	a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	***Section E of the Draft Mpumalanga BAR***

22 (2) (o)	any representations, and comments received in connection with the application or the basic assessment report	***Appendix E, Draft Mpumalanga BAR***
22 (2) (p)	the minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants	***Appendix E, Draft Mpumalanga BAR***
22 (2) (q)	any responses by the EAP to those representations, comments and views	***Appendix E, Draft Mpumalanga BAR***
22(2) I	Any specific information required by the competent authority.	**-**
22 (2) (s)	any other matters required in terms of sections 24(4)(a) and (b) of the Act.	**-**
22(3) (a)	A BAR must take into account any relevant guidelines; and;	***Section B of the Draft Mpumalanga BAR***
22(3) (b)	A BAR must take into account any practices that have been developed by the competent authority in respect of the kind of activity which is the subject of the application.	**-**

ABBREVIATIONS

BAR	Basic Assessment Report
BID	Background Information Document
BMP	Best Management Practise
CARA	Conservation of Agricultural Resources Act
CEMP	Construction phase Environmental Management Programme
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EPWP	Expanded Public Works Programme
GA	General authorisation in terms of the NWA
IA	Implementing Agent
I&APs	Interested and Affected Parties
IDP	Integrated Development Plans
NHRA	National Heritage Resources Act
NEMA	National Environmental Management Act
NEM: BA	National Environmental Management Biodiversity Act
NEM: PAA	National Environmental Management Protected Areas Act
NFA	National Forests Act
NWA	National Water Act
OHSA	Occupational Health and Safety Act
PC	Provincial Coordinator
PIP	Project Implementation Plan
RHP	River Health Programme
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SDF	Spatial Development Framework
SPWP	Special Public Works Programme

GLOSSARY OF TERMS

Auger: An instrument used for boring or perforating soils or rocks, in order to determine the quality of soil, or the nature of the rocks or strata upon which they lie, and for obtaining water (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Avulsion: An abrupt change in the course of a stream from one flow path to another.

Bedload: Sediment that is transported by being rolled or bounced along the bed of the stream (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Bedrock: The solid rock that underlies unconsolidated material, such as soil, sand, clay, or gravel (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

BAR: A report as described in regulation 23 of the EIA regulation, 2006 that describes the proposed activities and their potential impacts.

BID: A short document describing, and inviting I&APs to comment on, the proposed activities for which authorization is sought.

BMP: Procedures and guidelines to ensure the effective and appropriate implementation of wetland rehabilitation by WfWet implementers.

Biophysical: The biological and physical components of the environment (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Catchment: All the land area from mountaintop to seashore which is drained by a single river and its tributaries. Each catchment in South Africa has been subdivided into secondary catchments, which in turn have been divided into tertiary catchments. Finally, all tertiary catchments have been divided into interconnected quaternary catchments. A total of 1946 quaternary catchments have been identified for South Africa. These subdivided catchments provide the main basis on which catchments are subdivided for integrated catchment planning and management (consult DWAF [1994]) (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Collation Report: A report describing the Basic Assessment process followed for a provinces and collating the Basic Assessment reports for the various WfWet Projects within a province.

EAP: The individual responsible for the planning, management and coordination of the environmental impact assessments, strategic environmental assessments, environmental management plans and/or other appropriate environmental instruments introduced through regulations of NEMA.

Eco-log: A cylindrical wire mesh sleeve filled with organic material and/or soil used to prevent and/ or repair minor erosion.

Ecosystem Services Or 'eco services': The services such as sediment trapping or water supply, supplied by an ecosystem (in this case a wetland ecosystem).

EIA: A study of the environmental consequences of a proposed course of action via the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

MP: Details the methods and procedures for achieving environmental targets and objectives.

Gabion: A structure made of wire mesh baskets filled with regularly sized stones, and used to prevent and/ or repair erosion. They are flexible and permeable structures which allow water to filter through them. Vegetation and other biota can also establish in/around the habitat they create.

I&APs: People and organizations that have interest(s) in the proposed activities.

Environmental Impact: An environmental change caused by some human act.

Implementer: The person or organization responsible for the construction of WfWet rehabilitation interventions.

Intervention: An engineered structure such as a concrete or gabion weir, earthworks or re-vegetation that that achieves identified objectives within a wetland e.g. raising of the water table within a drainage canal.

Mitigation: Actions to reduce the impact of a particular activity.

Maintenance: The replacement, repair or the reconstruction of an existing structure within the same footprint, in the same location, having the same capacity and performing the same function as the previous structure ('like for like').

Perched wetland: A wetland where the wetland water table is higher than the local and regional watertable (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

PPP: A process of involving the public in order to identify issues and concerns, and obtain feedback on options and impacts associated with a proposed project, programme or development. Public Participation Process in terms of NEMA refers to: a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to specific project matters.

Project: An area of WfWet intervention generally defined by a quaternary catchment or similar management unit such as a national park inwhich a single implementer operates.

Q value: The peak flow (m^3/s) for which a structure is designed, based on a given likely return period rainfall within the catchment

Quaternary Catchment: All land area drained by a fourth order tributary river and its tributaries.

Rehabilitation: Refers to re-instating the driving ecological forces (including hydrological, geomorphological and biological processes) that underlie a wetland, so as to improve the wetland's health and the ecological services that it delivers.

Rehabilitation: Restoring processes and characteristics that are sympathetic to and not conflicting with the natural dynamic of an ecological or physical system (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Weir: A dam-type structure placed across a watercourse to raise the water table of the surrounding ground and trap sediment on the upstream face without preventing water flow. Weirs are generally used to prevent erosion from progressing up exposed gullies.

Wetland: "Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils." (SA Water Act of1998).

Wetland: Land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants living there (Wetland Management Series: WET-Origins, WRC Report TT 334/08, March 2008).

1. WORKING FOR WETLANDS PROGRAMME OVERVIEW

Working for Wetlands is a government programme (similar to Working for Water, Working on Fire and LandCare) managed by the South African National Biodiversity Institute (SANBI) on behalf of the national government departments of Environmental Affairs (DEA), Water Affairs (DWA), and Agriculture, Forestry and Fisheries (DAFF), and forms part of the Expanded Public Works Programme (EPWP). While the programme's primary focus is wetland rehabilitation, the protection, rehabilitation and sustainable use of those wetlands is simultaneously entrenched within the programme's core aims and objectives.

1.1 Vision and Objectives

The vision of Working for Wetlands is to facilitate the protection, conservation, rehabilitation and sustainable use of wetlands in South Africa, in accordance with national policies and commitment to international conventions and regional relationships. The two main objectives of the programme are wetland conservation in South Africa and poverty reduction through job creation and skills development amongst vulnerable and marginalised groups.

Given this approach of linking wetland conservation to sustainable economic development, the programme forms part of the EPWP, which seeks to draw significant numbers of unemployed into the productive sector of the economy. These individuals gain skills while they work thus increasing their capacity to earn an income. Projects are thus focused on rehabilitation, conservation and the appropriate use of wetlands in a way that attempts to maximize employment creation, support for small business and the transfer of skills to the unemployed and poor.

1.2 Budget and Scope of Work

The programme started off with a R20 million budget that was implemented across 14 projects in 2001. The budget has been increasing steadily and so has the number of projects implemented and beneficiaries employed. The programme is currently implemented across 35 projects countrywide with a budget of R83 million and employs over 1500 workers. The programme makes use of external support to implement its work. Seventeen implementing agents are currently employed and some are Section 21 companies. Implementers are responsible for employing contractors and their teams (workers), and ensuring that rehabilitation plans are adequately implemented. Funds are transferred from SANBI to the implementing agents, who in turn pay contractors and their teams.

Local people are recruited to work in projects. Wage information sourced from the best practice guidelines suggests that workers and contractors would be paid daily rates of R 82 and R 251[1] respectively and would be employed on limited term contracts, i.e. 24 months in a five-year cycle. Employment of workers complies with the Ministerial Determination on Special Public Works Programmes (Government Notice No. R 63, 25 January 2002) and the Code of Good Practice for Employment and Conditions of Work for Special Public Works Programmes (Government Notice No. R 64, 25 January 2002). Targets for employment specify that the programme's workforce should comprise at least 60% women, 20% youth and 2% disabled people.

Typical activities undertaken within the projects include:

- The construction of structures to control erosion in the wetland, trap sediment and raise water tables;
- The control of invasive alien plants within the immediate catchment, and in the wetland;
- Plugging of artificial drainage channels in the wetland;
- Addressing offsite causes of degradation in the catchment;
- Raising awareness of wetlands among workers, landowners and the general public;
- Providing adult basic education and training, and technical skills, and;
- Developing management plans for the rehabilitated wetlands.

In response to DEA's request to increase the labour component of all government funded projects, the Working for Wetlands project team has had to consider and where practically feasible incorporate softer, more labour intensive ways of rehabilitating wetlands in order to obtain the increased labour component. Accordingly as part of the planning for Phase 2, project team members have factored this requirement into their planning when designing for structures for wetland rehabilitation. This requirement has also had a direct impact on the wetlands that are to be rehabilitated. In some instances where wetlands have already been prioritised for rehabilitation for example, should the particular wetland require hard engineering (concrete structures for example) which require less labour than softer structures, the project team may decide to find other areas within which to work and/ or investigate other rehabilitation options that are more labour intensive for that area.

1.3 Training and Capacity Building

Working for Wetlands has established a working relationship with the Department of Public Works through the Working for Water programme. This

[1] without a Supervisor

partnership provides accredited training in accordance with the special public works Code of Good Practice agreements. Capacity building by Working for Wetlands operates primarily at two levels. The first concerns the need to ensure the development of adequate capacity to rehabilitate, manage and conserve wetlands in South Africa. The second relates to the commitment of Working for Wetlands as an expanded public works programme, to provide appropriate training to its workers in order for them to exit the programme with marketable skills and enhanced personal development. Workers receive two days of training, either vocational or social development-related, for every 22 days worked. Vocational training includes technical matters related to project activities, occupational health and safety, first aid, fire awareness, and business skills (contractor development). Social development includes literacy, primary health, personal finance, HIV/Aids and diversity awareness.

1.4 Support for Government, Non-Government And Private Agencies

Working for Wetlands engages with provinces, especially government departments and agencies responsible for biodiversity and environment, and municipalities through individual projects. A stronger working relationship with these spheres of government is being promoted through the programme's emphasis on partnerships. In particular, compatibility with Integrated Development Plans and rehabilitation project objectives will be a key area of future focus. Working for Wetlands encourages municipalities to participate in provincial wetland forums as these forums are the platform for the roll out of all the programmes' processes, including planning for future work. Provincial forums also offer support from the government departments and private sectors that are represented. Partnerships with non-governmental organizations and the private sector are also critical, requiring collaboration and cooperation with a wider range of stakeholders and role players in the wetland management field.

The strategic framework of Working for Wetlands underlines the need for a more refined planning process at catchment scale. Catchment scale planning seeks to promote ecosystem-scale outcomes, long-term custodianship, and the entrenchment of rehabilitation in broader local institutions and frameworks. The recent move to a systematic wetland rehabilitation planning process has provided a fertile and conducive platform for partnerships to be formed and/or strengthened as the process draws in a much wider stakeholder base.

1.5 Legislative Context

Working for Wetlands operates within the context of the Constitution Act, No. 108 of 1996, whereby everyone has the right to have the environment protected

and conserved for the benefit of present and future generations. Other national legislation that protects the environment includes the:

Table 2: Summary of applicable legislation

Title of legislation, policy or guideline:	Administering authority:	Date:
The Constitution of South Africa (Act 108)	National Government	1996
National Environmental Management Act (107)	Department of Environmental Affairs	1998
National Environmental Management Act (107) Amendment Act	Department of Environmental Affairs	1998
The National Water Act (36)	Department of Water Affairs	1998
Conservation of Agricultural Resources Act (43)	Department of Agriculture, Forestry & Fisheries	1983
National Heritage Resources Act (25)	National Heritage Resources Agency	1999
World Heritage Conventions Act (49)	Department of Environmental Affairs	1999
The National Environmental Management: Biodiversity Act (10)	Department of Environmental Affairs	2004
National Environmental Management: Protected Areas Act (57)	Department of Environmental Affairs	2003
The Mountain Catchments Areas Act (63)	Department of Water Affairs	1970
EIA Guideline Series, in particular: • Guideline 3 – General Guide to the Environmental Impact Assessment Regulations, 2006 (DEAT 2006) • Guideline 4 – Public Participation in support of the EIA regulations, 2006 (DEAT 2006) • Guideline 5 – Assessment of Alternatives and Impacts, 2006 (DEAT 2006)	Department of Environmental Affairs	

Title of legislation, policy or guideline:	**Administering authority:**	**Date:**
Mpumalanga Biodiversity Conservation Plan	Department of Economic Development & Environmental Affairs/ Mpumalanga Tourism and Parks Agency (MTPA)	
International Conventions, in particular: • The Ramsar Convention • Convention on Biological Diversity • United Nations Conventions to Combat Desertification • New Partnership for Africa's Development (NEPAD) • The World Summit on Sustainable Development (WSSD)		

This legislation informs and guides the Working for Wetlands programme in terms of its vision and objectives, whilst simultaneously regulating the wetland rehabilitation activities which Working for Wetlands carries out. Working for Wetlands has put in place systems to achieve compliance with all legislation. For example, Basic Assessments for Environmental Authorisation are carried out for all listed activities involved in wetland rehabilitation to comply with NEMA.

In terms of Section 39 of the National Water Act (No. 36 of 1998) (NWA), a General authorisation[2] (GA) has been granted for certain activities that are listed under the NWA that usually require a Water Use License; as long as these activities are undertaken for wetland rehabilitation. These activities include '*impeding or diverting the flow of water in a watercourse*[3]' and '*altering the bed, banks, course or characteristics of a watercourse*[4]' where they are specifically undertaken for the purposes of rehabilitating[5] a wetland for conservation purposes.

A Memorandum of Agreement has been entered into between the DAFF, DEA, DWA and SANBI for the Working for Wetlands programme. Through co-operative governance and partnerships, this Agreement aims to streamline the authorisation processes to facilitate efficient processing of applications for

[2]Government Notice No. 1198, 18 December 2009

[3]Section 21(c) of the NWA, No. 36 of 1998

[4]Section 21(i) of the NWA, No. 36 of 1998

[5]Defined in the NWA as "*the process of reinstating natural ecological driving forces within part of the whole of a degraded watercourse to recover former or desired ecosystem structure, function, biotic composition and associated ecosystem services*"

authorisation of wetland rehabilitation activities under CARA, NEMA and NWA respectively.

In terms of the National Heritage Resources Act (No. 25 of 1999) (NHRA), Section 38; "any person who intends to undertake a development categorised as-

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300min length;
(b) the construction of a bridge or similar structure exceeding 50 m in length;
(c) any development or other activity which will change the character of a site-
    (i) exceeding 5 000 m^2 in extent; or
    (ii) involving three or more existing erven or subdivisions thereof; or
    (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,"

must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely the South African Heritage Resources Agency (SAHRA) or the relevant provincial heritage agency. These agencies would in turn indicate whether or not a full Heritage Impact Assessment (HIA) would need to be undertaken.

Section 38(8) of the NHRA specifically excludes the need for a separate HIA where the evaluation of the impact of a development on heritage resources is required in terms of an EIA process. Accordingly, since the impact on heritage resources would be considered as part of the EIA process outlined here, no separate HIA would be required. SAHRA or the relevant provincial heritage agency would review the EIA reports and provide comments to DEA, who would include these in their final environmental decision. However, should a permit be required for the damaging or removal of specific heritage resources, a separate application would have to be submitted to SAHRA or the relevant provincial heritage agency for the approval of such an activity.

SANBI has engaged with SAHRA regarding the wetland planning process and has committed to achieving full compliance with the heritage act over the next few years. It has been proposed that preliminary desktop analysis of the various proposed project areas be conducted to allow SAHRA and, where applicable, the provincial heritage authorities opportunity to provide guidance on whether further, detailed assessments are required.

2. INTRODUCTION

Aurecon South Africa (Pty) Ltd was appointed by SANBI to undertake the various project activities and associated reporting required for the various phases of the rehabilitation planning cycle. These included Phase 1 Reports, the wetland rehabilitation plans as well as the Basic Assessment Reports required for each project area within all nine provinces. Figure 1, below, graphically depicts the entire planning process employed by Working for Wetlands to rehabilitate wetlands.

The flow diagram (Figure 1) also clearly demonstrates the point at which various consent forms must be approved via signature from the directly affected landowner. SANBI's Provincial Coordinators are responsible for undertaking the necessary landowner engagement and for ensuring that the requisite landowner consent forms required as part of Phase 1 and 2 of this project are signed. These include:

- WW(0): Standard operating procedure
- WW(1): Wetland survey and Inspection consent,
- WW(2): Terms and Conditions for carrying out wetland rehabilitation,
- WW(3): Wetland Rehabilitation Activities Consent,
- WW(4): Property Inspection Prior to Wetland Rehabilitation, and
- WW(5): Notification of Completion of Rehabilitation.

Refer to **Appendix E** for a copy of the landowner agreements.

The Phase 1 prioritisation and identification of wetlands thereof for rehabilitation planning is described in the separate Phase 1 Planning Report for each project.

The 2013/2014 planning approach has been one of consolidation, with limited additional Phase 2 planning. As a result only eight (8) new wetlands, in four (4) provinces have been prioritised for site visits this year (2012). All previously planned and designed interventions will be included in the 2013/2014 implementation period, along with maintenance, alien clearing, and any new interventions which receive authorisation in the current planning phase.

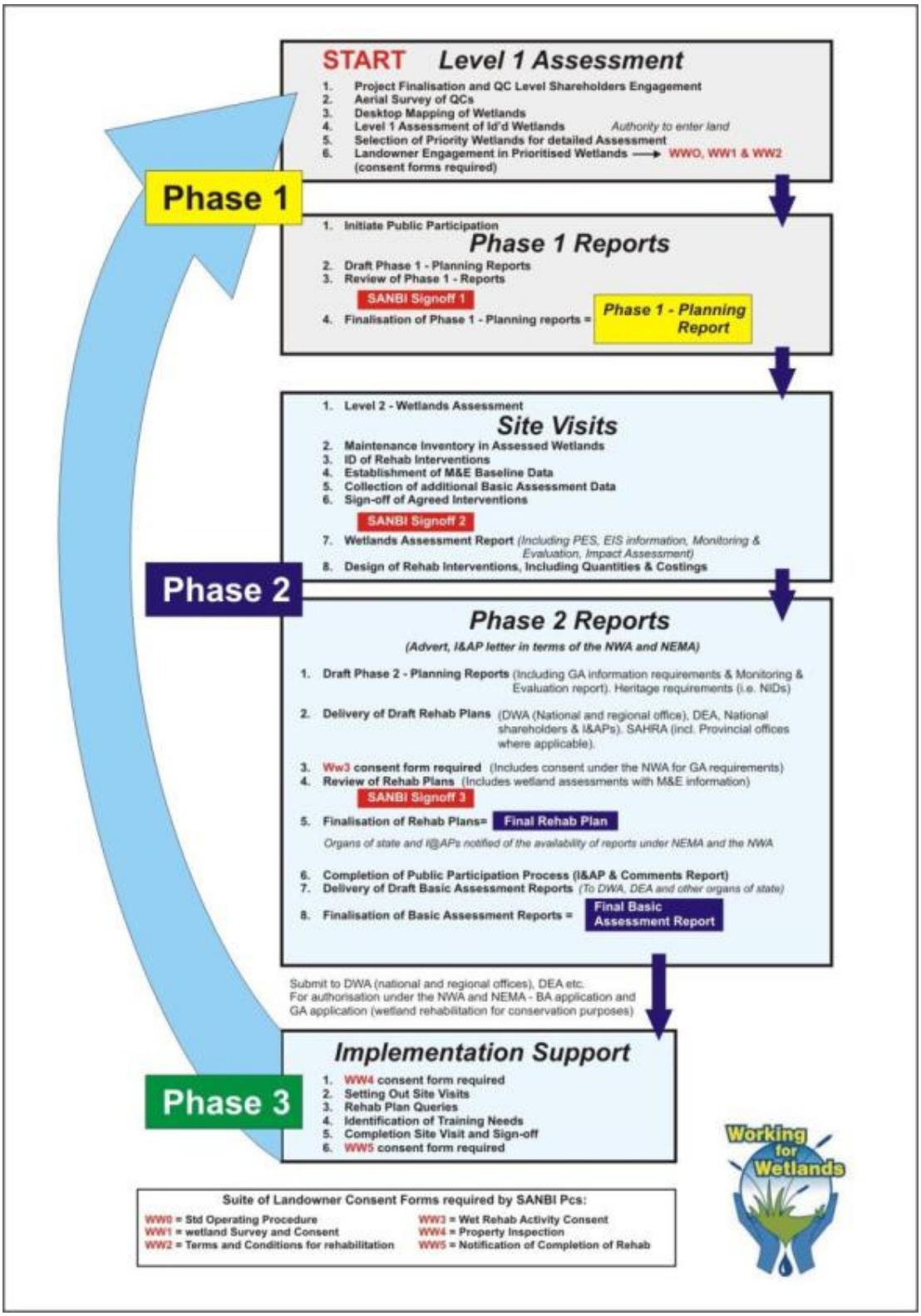


Figure 1: The three phases that must be undertaken for the successful rehabilitation of wetlands

This document comprises the wetland rehabilitation plan for the Wakkerstroom project and will be the primary working document for the implementation of the project via construction/ undertaking of interventions[6] required for wetland rehabilitation. The document details the general methodology that has been adopted for the planning of rehabilitation interventions for identified wetlands. Details of the rehabilitation plan for each wetland and the individual intervention designs within each wetland are then presented, along with baseline Monitoring and Evaluation (M&E) data. Detailed wetland assessment reports and design drawings are included as appendices in this report.

Basic Assessment Reports are compiled as separate documents (one for each province) and are submitted to National DEA for their environmental authorisation decision. This Rehabilitation Plan is attached as an Appendix to the BAR and is therefore also submitted to DEA for their consideration as part of their decision-making process.

Upon approval of this wetland rehabilitation plan by both DEA and the directly affected landowners, the work detail for the project will be implemented within a year with on-going monitoring being undertaken from thereon.

[6] This could include soft options such as alien clearing, eco-logs, gabion structures as well as hard structures, for example weirs.

3. GENERAL METHODOLOGY

The wetlands that were prioritised for further detailed assessment in the Phase 1 planning stage were assessed in detail during the fieldwork. This assessment is described in detail below.

Increased labour requirement for the WfWetlands Programme (refer to Section 1.2 above).

As a result of the increased labour requirement for the WfWet programme, the project team were required to investigate more labour intensive intervention options for wetland rehabilitation. These included soft engineering options such as berms, eco-logs as well as alien clearing.

This also resulted in the project team having to investigate other wetland areas in order to meet this requirement. Consequently, some of the wetlands prioritised during Phase 1 would not be rehabilitated during this planning year (due to the large amount of hard engineering required), while new additional wetlands were identified during the Phase 2 site visits as their rehabilitation requirements contributed towards meeting the increased labour component for the programme.

Rehabilitation work within floodplain systems

Based on lessons learnt and project team discussions during the National Prioritisation workshop in November 2010, SANBI took an in principle decision regarding work within floodplain systems.

Recognising the ecosystem services provided by floodplain wetlands and the extent to which they have been transformed, SANBI do not intend to stop undertaking rehabilitation work in floodplains entirely. Instead, SANBI propose to adopt an approach to the rehabilitation of floodplain areas that takes into account the following guiding principles:

1. As a general rule, avoid constructing hard interventions within an active floodplain channel; and rather
2. Explore rehabilitation opportunities on the floodplain surface using smaller (possibly more) softer engineering options outside of the main channel.

When rehabilitation within a floodplain setting is being contemplated, it will be necessary to allocate additional planning resources, including the necessary specialist expertise towards ensuring an adequate understanding of the system and appropriate design of interventions.

3.1 Site Visits

Site visits to prioritised wetlands were conducted by project teams consisting of:

- a Wetland Ecologist,
- an Engineer,
- an Environmental Assessment Practitioner,
- the Working for Wetlands Provincial Coordinator, and where possible and/ or appropriate,
- the Implementing Agent's Project Manager.

One Phase 2 site visit was undertaken for the following project:

1. Goedgevonden: 16 August 2012
2. Paardeplaats: 17 August 2012

3.2 Wetland Assessments

The time and resources required for detailed assessments of the wetlands was generally limited, and thus a rapid procedure was adopted to assist the project team in systematically carrying out the assessments under constraints. The procedure was based on the following steps:

a. Assess impacts and threats

The following steps were used by the wetland ecologist to assess the impacts and threats within each wetland system:

Description of the hydro-geomorphic setting of the wetland according to Kotze *et al.* (2005);

Verification and description of the overall health of the wetland at a Level 1 assessment using WET-Health (Macfarlane *et al.*, 2006);

Based on the above findings, identification of specific impacts and/or threats to be addressed by structural rehabilitation and description of these at a Level 2. For example, for headcut erosion, the specific dimensions and level of activity of headcuts would be described.

b. Set rehabilitation objectives and choose appropriate measures for achieving the objectives

Rehabilitation objectives would be informed by the above assessments (*e.g.*, if the primary threat to the wetland was identified as headcut erosion threatening to propagate through the wetland then an appropriate rehabilitation objective would be to halt propagation of the erosion headcut). The engineer would assist the wetland specialist in choosing appropriate interventions to achieve the identified rehabilitation objectives.

c. Assess the likely contribution of rehabilitation interventions to wetland health and ecosystem delivery

An assessment of the predicted contribution that the identified rehabilitation interventions will make to improving wetland health and ecosystem delivery through addressing the identified impacts/threats would be required. Without these assessments, a wetland rehabilitation programme is unlikely to have a well-informed basis on which to improve the rehabilitation's "return on investment" (with return being measured in terms of wetland health and ecosystem services delivery). This would directly link into the *WfWet* Monitoring and Evaluation Framework.

The following steps were followed to assess the contribution of rehabilitation interventions within each wetland system:

- Identify the spatial area likely to be affected by the proposed intervention/s.
- Assess the benefits that are likely to result from achievement of the rehabilitation objective/s in terms of the integrity of the affected area of the wetland (using WET-Health) and the ecosystem services that the area delivers (using WET-Ecoservices: Kotze *et al.*, 2005).

The same approach was used for the assessment of the different threats/impacts that would be addressed through rehabilitation. In this instance, the situation without rehabilitation (i.e. no intervention or *status quo*) would be compared with the situation with rehabilitation. For health, both situations would be scored on a scale of 0 (critically altered) to 10 (pristine), and this would be undertaken for the hydrology, geomorphology and vegetation components of health. The benefit achieved would be the improvement in relation to the maximum score. For example, in areas threatened by headcut erosion which are to be rehabilitated by halting the spreading of the headcut, the benefits in terms of health would be determined based on the difference between the current health and the projected health if the headcut proceeded to erode through the threatened area. In such a case, stopping the expansion of the headcut would presumably secure the current situation.

Refer to **Appendix A** which contains the Wetland Assessment Reports.

3.2.1 Identification and Location of Intervention Designs

The project teams evaluated the various rehabilitation intervention options available and selected the most appropriate to achieve the rehabilitation objectives for the wetland which included factoring in the increased labour component as required by DEA. Any previously planned interventions that had not been implemented or included into the 2012/13 PIPs were assessed and included into the current year's selection, if appropriate to the re-assessed

rehabilitation objectives for the wetland. Agreed cost/benefit ratios in terms of 'Rands per hectare of rehabilitated wetland' were taken into account, along with operational considerations and larger scale project objectives.

After the appropriate interventions had been decided by the planning team, the engineer, in consultation with the wetland specialist, was responsible for choosing the most appropriate designs and locations for the identified rehabilitation interventions in order to achieve the identified rehabilitation objectives. GPS coordinates and digital photographs – sufficiently detailed to clearly identify the locations were taken for record purposes. Appropriate dimensions of the locations were measured in order to be able to design and calculate quantities for the interventions.

3.2.2 Intervention naming convention

A new naming convention was introduced in the 2011/2012 planning phase and this has been continued in this years' Rehabilitation plans.

The **historical naming convention** for interventions is explained below:

A00A-00-000, where

Number	**Explanation**
A00A	quaternary number
00	wetland number
000	intervention number

The accepted **naming convention** which has been applied to all interventions (old and new) is explained below with examples being provided as well.

A00A-00-000-00 (new),

A00A-00-000-01 (maintenance), where

Number	**Explanation**	
A00A	quaternary number	
00	wetland number	
200	intervention number with the '**200**' included for differentiation from previous interventions	

00	**New** intervention	**01**	**Maintenance** to intervention

An additional two digits will therefore be added to the end of each of the intervention numbers to indicate maintenance on this specific intervention and/ or whether the structure is new (00) for tracking purposes. All new interventions will have a default of 00. Should built structures require maintenance, they would be numbered numerically beginning with '01' e.g. 01, 02, 03, etc. for each year that maintenance is undertaken on the intervention.

In addition, the new naming convention also added a '200' digit in the front of the intervention number to avoid confusion from previously named interventions. This is illustrated in the 'new intervention number column' in Table 6 in section 4.5 below.

3.3 Collection of Monitoring and Evaluation Baseline and Basic Assessments Data

In accordance with WET-Rehab-Evaluate (Cowden & Kotze, 2007) the collection of baseline monitoring information is important to allow the evaluation of the performance of wetland rehabilitation activities. Monitoring and evaluation facilitate the dissemination of lessons learnt and provide a means of reporting on the success of specific wetland rehabilitation initiatives. The monitoring and evaluation (M&E) of an identified wetland rehabilitation project's performance is therefore considered vital to inform the evaluation of wetland rehabilitation success. Baseline monitoring needs to be carried out prior to the implementation of rehabilitation activities to provide comparable data for monitoring at a later stage, following the wetland rehabilitation.

While the engineer was working on measurement of the intervention locations, the wetland ecologist would gather the additional data required for M&E baselines which would include the following:

- Photographs and GPS co-ordinates of the identified problems;
- Fixed-point photography (in accordance with the guidelines outlined in WET-Rehab-Evaluate: Cowden & Kotze, 2007);
- WET-Health information (allowing the comparison of wetland ecological integrity before and after rehabilitation activities); and
- Details relating to the estimated hectare equivalents.

Any additional data/information required for the assessment of the potential impacts of the proposed interventions and construction activities was also collected by the wetland ecologist and the EAP to inform the Basic Assessments.

At the end of the site visit a location layout of the agreed interventions and rehabilitation objectives would be signed off by the WfWet provincial coordinator and landowner, as indicated by SANBI Signoff 2 in Figure 1.

3.4 Engineering Design

The detailed procedure followed by the engineers is described in the Engineering Design Brief, which documents the procedure agreed upon by Aurecon and SANBI. The document also addresses important issues such as risk and liability. A summary of the process followed for the engineering design is described below:

1. A hydrological assessment is made to quantify the volume of water expected to be dealt with by the intervention for various recurrence intervals. The results of this assessment allow the engineer to select a design flow to be applied to the intervention.
2. Soil types and their anticipated characteristics are assessed including DCP results or geotechnical investigations where these have been undertaken.
3. Construction materials are selected based on a range of site specific criteria including expected velocities, availability of materials such as rock, labour intensive targets, maintenance requirements etc.
4. Interventions are designed based on the above so that they will meet the objectives for wetland rehabilitation.
5. The designs are drafted to show, at a minimum, a plan view, a longitudinal section and front elevation at appropriate scales, and appropriate dimensions. A legend indicating basket sizes is included for gabion structures to improve design clarity for the implementers.
6. Bills of quantities are calculated for the designs and cost estimates made based on unit costs and norms for each project area, as agreed with WfWet.
7. The estimated budget allocation towards labour is indicated.
8. Maintenance requirements for existing interventions in the assessed wetlands are similarly detailed and costs calculated.

The engineer also reviews and, if necessary, adjusts any previously planned interventions that are included into the current rehabilitation plan.

3.5 Development of Rehabilitation Plans

The standardised rehabilitation plan format has previously been approved by WfWet's Manager: Planning, Monitoring and Evaluation.

Summaries of the wetland prioritisation, problems and rehabilitation objectives were included into the main body of the rehabilitation plans.

Detailed wetland assessment reports, based on, *inter alia*, the information collected during the implementation of WET-Tools, were prepared by the wetland ecologist and/ or the environmental assessment practitioner for each project, and included as an appendix in each project's rehabilitation plans.

The draft rehabilitation plans are submitted to WfWet for a two week review period. Any comment received during this period is taken into account in the finalisation of the rehabilitation plans.

3.6 Reporting Format

All relevant information acquired during the assessments and field visits has been included in this document and its appendices in a hierarchy as shown in **Figure 2** below.

All intervention locations are given in geographical coordinates, (degrees, minutes and seconds), based on the WGS84 datum.

Mapping was done in Albers Equal Area Conic projection, WGS84 datum. The grids displayed on all maps are geographic and measured in Degrees Minutes and Seconds. The scale bar on each map is based on Albers Equal Area Conic projection and measured in metres.

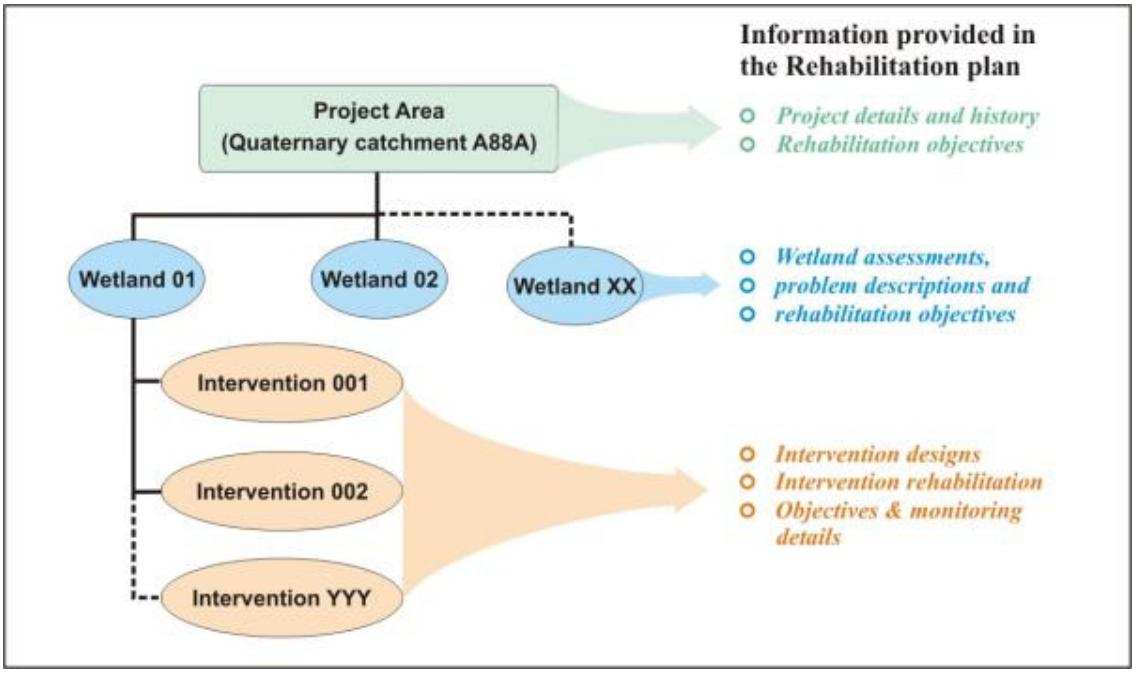


Figure 2: Hierarchy used in the Wetland Rehabilitation Plan

4. PROJECT DESCRIPTION

Goedgevonden wetland:

The Wakkerstroom wetland rehabilitation project was historically located in the V31A and W42C quaternary catchments near the town of Wakkerstroom and Luneburg in the Mpumalanga province. After work in the Wakkerstroom wetlands was completed, the focus shifted to the Goedgevonden wetland (W42C) near Luneburg. The aim of the wetland rehabilitation has been the stabilisation of active erosion and the deactivation of drainage canals and furrows resulting in the desiccation of the identified wetland systems. In 2011 work was also extended on the farm Goedgevonden to include alien clearing, follow up spraying of alien vegetation and the re-seeding of areas previously cleared by the landowner

The 2012/2013 planning cycle addresses the last interventions needed in the Goedgevonden wetland and future planning cycles will identify new wetlands and properties in the catchment area.

Paardeplaats Farm:

Work on the farm Paardeplaats commenced in 2011 and included alien clearing, follow up spraying of alien vegetation and the re-seeding of areas previously cleared by the landowner.

The 2012/2013 planning cycle extended work on the farm to include the rehabilitation and stabilisation of an eroded dirt road, the decommissioning of a highly degraded dirt road, stabilisation of headcut erosion, rehabilitation of gullies and rehabilitation of a hillside seep area.

The project as a whole has further been aligned with the extent of the National Grasslands Biodiversity Programme's (NGBP) demonstration area in the Wakkerstroom/Luneburg area. Both Goedgevonden and Paardeplaats fall within the newly proclaimed Kwa Mandlangampisi Protected Environment. The project area does extend into KwaZulu-Natal, but the focus of the wetland rehabilitation is the wetlands and tributaries within the Mpumalanga province.

The Wakkerstroom project area in the W42C catchment occurs within the upper reaches of the KwaNtombe River, which is considered to be an important water resource within the region. A range of wetland types, characteristic of the region, are represented in the area, including permanent and seasonal marshes, peatlands and seepage areas. The wetlands within the area are considered to be important from a water quantity and quality perspective, especially due to their position in the upper reaches of the river.

A review of the Mpumalanga Biodiversity Conservation Plan (MBCP) highlights that the majority of the Wakkerstroom project area is considered as

'Irreplaceable' in terms of its contribution towards aquatic biodiversity and terrestrial biodiversity. The rehabilitation of the wetlands within the catchment is likely to contribute towards the maintenance of the aquatic and terrestrial biodiversity of the region. The Wakkerstroom wetland is also considered to be regionally important in terms of the maintenance of biological diversity, with the reserve supporting a number of Red Data species, mostly bird species.

4.1 Project Details

Table 3: Project details

Project Name	Wakkerstroom
Region (Province)	Mpumalanga
Project Budget	R 1 633 725
Planning Category	Category 1
Nearest Town/s	Luneburg
Partnership	The Bateleurs

Figure 3: Goedgevonden wetland looking to the south

Figure 4: Paardeplaats wetland/seep looking to the northwest

Figure 5: Typical dryland erosion to be rehabilitated on Paardeplaats

The SANBI Provincial Co-ordinator annually updates the Project's structure reconciliation spreadsheet to accurately reflect historical and current activities within the various projects. Please find the latest updated spreadsheet attached as **Appendix I.**

The scope of the project is listed in the table below:

Table 4: Project scope

Quaternary Catchments	**W42C and V31A**
Quaternary Catchment area (Ha)	38 470.868 Ha
Number of wetlands identified during the assessment	2
Extension of existing work (previous financial year)	Yes
Work to commence at new wetlands in 2012/ 2013	Yes
Available budget for new interventions	R1 633 725
Available budget for maintenance to existing interventions	
Estimated cost of new interventions	Total: R 4,585,955 (Goedgevonden: R 714 195) (Paardeplaats: R 3 803 661)
Estimated cost of maintenance to existing interventions	R 68,098.35

4.2 Projected Rehabilitation Indicators

The rehabilitation planning process relies on the measurement of wetland ecological integrity based on the assessment of the hydrology, geomorphology and vegetation components of the specified systems. In theory this information could be converted into a hectare equivalent which could serve as a baseline indicator to then provide a projection of the area of wetland habitat gained or secured. In practice the level of confidence associated with interpretations of this nature are usually of low confidence and difficult to defend and hence should be interpreted with great caution. For example, this approach should not be followed for hectare equivalents secured where a large wetland complex, with many contiguous tributary arms of unknown size are present upstream. Similarly, the area of wetland gained should not be determined if there isn't good knowledge of inter alia the hydrogeological characteristics of both the bedrock and unconsolidated sedimentary cover.

In well-known systems rehabilitation plans can outline the following projected values for the proposed wetland rehabilitation, which can be used as an indicator of wetland rehabilitation success within each wetland system:

Wetland No.	Area (ha)	Current hectare equivalents	Projected hectare equivalents gained	Total projected hectare equivalents	% Increase on current hectare equivalents	Projected hectare equivalents secured
W42C-01	66	40.35	14.52	54.87	35.98	N/A
W42C-02	0.61	0.48	0.03	0.51	4.91	N/A

Please note that important factors such as biodiversity, species habitat, sense of place cultural significance etc. are not incorporated into hectare equivalents and therefore the full value of the system is not quantified. For the purpose of this report and due to the reasons above, the above table only reflects the amount of hectares physically gained as a result of the interventions.

4.3 Prioritisation of Wetlands

Based on the wetland assessments conducted, the current progress of implementation within the project and the prioritisation of the rehabilitation interventions detailed in the following sections, the wetlands must be prioritised for rehabilitation in the following order:

Table 5: Prioritisation of wetlands

Priority	Wetland number	Wetland name	Rationale
1	W42C-01	Goedgevonden	Continuation of previous work. Due to the size and ecological contribution of the Goedgevonden wetland it is considered to be of high priority.
2	W42C-02 (Stabilisation of headcut erosion)	Paardeplaats	Headcut erosion in this seep is likely to undermine the hydrology and geomorphology of the wetland, and therefore needs to be addressed.
3	W42C-02 (Rehabilitation of seep/wetland area)	Paardeplaats	The impacts of the existing road through the seep need to be mitigated to avoid further degradation.
4	W42C-02 (Decommissioning and Rehabilitation of roads)	Paardeplaats	These activities are geared towards assisting with the effective management of the reserve.

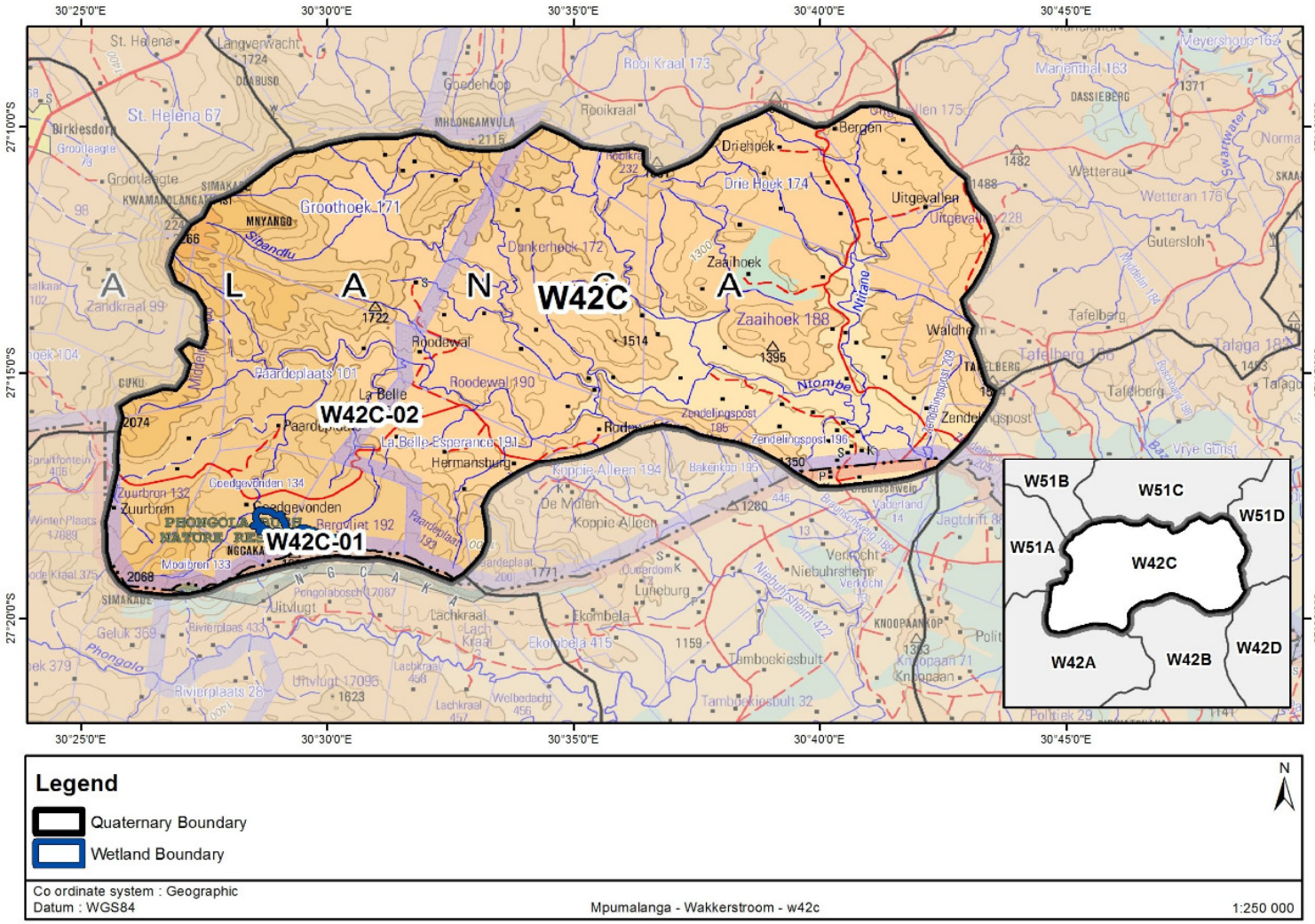


Figure 6: Topographic map showing W42C quaternary catchment's locality, cadastral boundaries and access routes

4.5 Intervention labelling

The following table provides a list of interventions requiring redesign, maintenance and or new structures for this project and their associated new intervention number.

Table 6: Summary of the interventions including a cross reference of intervention numbers

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
NEW				
Goedgevonden				
Earthen Diversion Berm	W42C-01-027	W42C-01-203-00	Construct an earthen diversion berm to divert all flows out of the eastern channel.	Wakkerstroom Final Rehab Plan: Feb 2012
Earthen Diversion Berm	W42C-01-028	W42C-01-204-00	Construct an earthen diversion berm to divert all flows out of the eastern channel	Wakkerstroom Final Rehab Plan: Feb 2012
Reno Matrass	N/A	W42C-01-205-00	Construct a Reno mattress in-channel protection structure to set the base level of the eastern channel.	Wakkerstroom Final Rehab Plan: Feb 2012
Gabion Weir	N/A	W42C-01-206-00	Construct a gabion weir to divert flow out of the western channel onto the western parts of the wetland.	Wakkerstroom Final Rehab Plan: Feb 2012
Gabion Diversion Wall	N/A	W42C-01-207-00	Construct a gabion diversion berm to divert flow out of the eastern channel	Wakkerstroom Final Rehab Plan: Feb 2012

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Earthen Diversion Berm	N/A	W42C-01-208-00	Construct an earthen diversion berm to divert all flows out of the eastern channel onto the eastern parts of the wetland.	Wakkerstroom Final Rehab Plan: Feb 2012
Concrete Diversion Berm	N/A	W42C-01-209-00	Construct a concrete diversion berm to divert flow out of the eastern channel onto the eastern parts of the wetland.	Wakkerstroom Final Rehab Plan: Feb 2012
Paardeplaats				
Gabions Diversion Wall and Earthen Berms with seeding and biojute	N/A	W42C-02-208-00	Decommission and rehabilitate old road	Wakkerstroom Final Rehab Plan: Feb 2012
Concrete strips and gabion protection	N/A	W42C-02-209-00	Protection of road through construction of concrete strips and gabion cut off wall	Wakkerstroom Final Rehab Plan: Feb 2012
Revegetation of hillslope	N/A	W42C-02-210-00	Contouring, reseeding	Wakkerstroom Final Rehab Plan: Feb 2012
Rockpacks	N/A	W42C-02-211-00	Rock packs to control erosion next to road	Wakkerstroom Final Rehab Plan: Feb 2012
Rockpacks	N/A	W42C-02-212-00	Rock packs to control erosion next to road	Wakkerstroom Final Rehab Plan: Feb 2012
Surface cross drain	N/A	W42C-02-213-00	Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Revegetation	N/A	W42C-02-214-00	Contouring, reseeding	Wakkerstroom Final Rehab Plan: Feb 2012
Rockpacks	N/A	W42C-02-215-00	Rock packs	Wakkerstroom Final Rehab Plan: Feb 2012
Gully stabilisation	N/A	W42C-02-216-00	Rock packs and gabion diversion walls	Wakkerstroom Final Rehab Plan: Feb 2012
Surface cross drains, gabion diversion walls and earthen berms	N/A	W42C-02-217-00	Deactivate old road and protect new road	Wakkerstroom Final Rehab Plan: Feb 2012
Concrete strips and backfill trench	N/A	W42C-02-218-00	Protect sensitive area	Wakkerstroom Final Rehab Plan: Feb 2012
Concrete weir	N/A	W42C-02-219-00		Wakkerstroom Final Rehab Plan: Feb 2012
Surface Cross Drain	N/A	W42C-02-220-00	Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012
Surface Cross Drain	N/A	W42C-02-221-00	Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012
Surface Cross Drain	N/A	W42C-02-222-00	Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012

Descriptive name	Old intervention number (if applicable)	New Intervention number	Proposed action	Reference document
Surface Cross Drain	N/A	W42C-02-223-00	Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012
Surface Cross Drain	N/A	W42C-02-224-00	Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012
Surface Cross Drain	N/A	W42C-02-225-00	Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012
Surface Cross Drain	N/A	W42C-02-226-00	Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012
Surface Cross Drain	N/A		Construction of surface cross-drains	Wakkerstroom Final Rehab Plan: Feb 2012
MAINTENANCE				
Excavation	V31A-01-014	V31A-01-201-01	Excavate existing channel to spread a portion of the flows into the wetland area southwest of main channel	
INTERVENTION REDESIGNS				
N/A				

The intervention designs/ drawings included in this Rehabilitation plan have been labelled according to the **new naming convention** only. For historical labelling of interventions, please use the table above as a cross reference.

5. GOEDGEVONDEN WETLAND –W42C-01

The Goedgevonden wetland is generally an unchannelled valley-bottom wetland that is characterised by soils with high organic matter content.. The Goedgevonden wetland forms part of a large valley-bottom wetland system, with pristine peatlands 700m upstream of the Goedgevonden wetland, The system is considered critical in terms of habitat provision for wetland-dependant species, including Wattled Crane..

The assessment of each wetland, its problems and the development of rehabilitation objectives are described in detail in **Appendix A**: Wetland Assessment Reports. The following sections provide a brief summary for each wetland.

5.1 Wetland Details

Wetland Name	Goedgevonden
Wetland Number	W42C-01
River System Name	Upper reaches of KwaNtombe River
Land Use in Catchment	Livestock Farming, crop production
Land Use in Wetland	Livestock production
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	31 July 2008 – Rapid Wet Tools Assessment
Wetland Assessor(s)	Craig Cowden
Wetland size	66 Ha

5.2 Biophysical characteristics of the wetland

5.2.1 Gradient of the site (section B1 of the BAR)

Flat	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

5.2.2 Location in landscape (section B2 of the BAR)

Indicate the landform(s) that best describes the site:

Ridgeline ☐ Closed valley ☐ Undulating plain / low hills ☐

Plateau		Open valley	x	Dune	
Side slope of hill/mountain		Plain		Seafront	

5.2.3 Groundwater, soil and geological stability of the site (section B3 of the BAR)

Is the site(s) located on any of the following?

	Alternative S1:	
Shallow water table (less than 1.5m deep)	YES	
Dolomite, sinkhole or doline areas		NO
Seasonally wet soils (often close to water bodies)	YES	
Unstable rocky slopes or steep slopes with loose soil		NO
Dispersive soils (soils that dissolve in water)	Yes	
Soils with high clay content (clay fraction more than 40%)		NO
Any other unstable soil or geological feature	YES	
An area sensitive to erosion	YES	

5.2.4 Groundcover (section B4 of the BAR)

Alternative S1:

Natural veld - good condition[E]	Natural veld with scattered aliens[E]	Natural veld with heavy alien infestation[E]	Veld dominated by alien species[E]	Gardens
Sport field	Cultivated land	Paved surface	Building or other structure	Bare soil

If any of the boxes marked with an "[E] "is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn't have the necessary expertise.

Has a specialist been consulted?		NO

Wetland ecologist, Craig Cowden, did the wetland assessment which included present ecological condition.

Species of special concern known to occur in the quaternary catchment:

- Wattle Crane (*Bugeranus carunculatus*) – Critically endangered

5.2.5 Surface water (section B5 of the BAR)

Indicate the surface water present on and or adjacent to the site and alternative sites?

Perennial River	YES	NO	UNSURE
Non-Perennial River	YES	NO	UNSURE
Permanent Wetland	YES	NO	UNSURE
Seasonal Wetland	YES	NO	UNSURE
Artificial Wetland	YES	NO	UNSURE
Estuarine / Lagoonal wetland	YES	NO	UNSURE

If any of the boxes marked YES or UNSURE is ticked, please provide a description of the relevant watercourse.

The purpose of the Working for Wetland's project is wetland conservation and indirectly the protection of biodiversity and South Africa's water resources. Therefore all proposed rehabilitation interventions are located within disturbed wetland areas, seepage zones and rivers with significant problems related to erosion, sedimentation, biodiversity loss, alien infestation, etc.

The KwaNtombe River is an Order 1 tributary to the Pongola River which drains the eastern escarpment towards the Indian Ocean where it finally terminates near Maputo (Mozambique).

5.2.6 Landuse character of surrounding area (section B6 of the BAR)

Indicate land uses and/or prominent features that currently occur within a 500m radius of the site and give description of how this influences the application or may be impacted upon by the application:

Natural area	Dam or reservoir	Polo fields
Low density residential	Hospital/medical centre	Filling station[H]
Medium density residential	School	Landfill or waste treatment site
High density residential	Tertiary education facility	Plantation
Informal residential[A]	Church	Agriculture

Retail commercial & warehousing	Old age home	River, stream or wetland
Light industrial	Sewage treatment plant[A]	Nature conservation area
Medium industrial[AN]	Train station or shunting yard[N]	Mountain, koppie or ridge
Heavy industrial[AN]	Railway line[N]	Museum
Power station	Major road (4 lanes or more)[N]	Historical building
Office/consulting room	Airport[N]	Protected Area
Military or police base/station/compound	Harbour	Graveyard
Spoil heap or slimes dam[A]	Sport facilities	Archaeological site
Quarry, sand or borrow pit	Golf course	Other land uses (describe)

If any of the boxes marked with an "[N] "are ticked, how will this impact / be impacted upon by the proposed activity?

N/A

If any of the boxes marked with an "[An]" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

N/A

If any of the boxes marked with an "[H]" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

N/A

Does the proposed site (including any alternative sites) fall within any of the following:

Critical Biodiversity Area (as per provincial conservation plan)	YES	NO
Core area of a protected area?	YES	NO
Buffer area of a protected area?	YES	NO
Planned expansion area of an existing protected area?	YES	NO
Existing offset area associated with a previous Environmental Authorisation?	YES	NO

5.2.7 Cultural or historical features (section B7 of the BAR)

Are there any signs of culturally or historically significant elements, as defined in section 2 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), including Archaeological or paleontological sites, on or close (within 20m) to the site? If YES, explain:	YES	NO
	Uncertain	
N/A		

If uncertain, conduct a specialist investigation by a recognised specialist in the field (archaeology or palaeontology) to establish whether there is such a feature(s) present on or close to the site. Briefly explain the findings of the specialist:

Not Applicable – A copy of the 2012 Wakkerstroom BAR and Rehabilitation Plan will however be provided to the relevant heritage authorities for consideration.		
Will any building or structure older than 60 years be affected in any way?	YES	NO
Is it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)?	YES	NO

If YES, please provide proof that this permit application has been submitted to SAHRA or the relevant provincial authority.

5.2.9 Biodiversity (Section B9 of the BAR)

Indicate the applicable biodiversity planning categories of all areas on site and indicate the reason(s) provided in the biodiversity plan for the selection of the specific area as part of the specific category)

Systematic Biodiversity Planning Category				**If CBA or ESA, indicate the reason(s) for its selection in biodiversity plan**
Critical Biodiversity Area (CBA)	**Ecological Support Area (ESA)**	**Other Natural Area (ONA)**	**No Natural Area Remaining (NNR)**	The Goedgevonden wetland area is considered as 'Irreplaceable' in terms of its contribution towards aquatic biodiversity and terrestrial biodiversity and it supports a number of Red Data species. The wetland also plays an important role in maintaining the water quality and quantity in the W42C quaternary catchment area.

Indicate and describe the habitat condition on site:

Habitat Condition	**Percentage of habitat condition class (adding up to 100%)**	**Description and additional comments and observations (Incl. additional insight into condition, e.g. poor land management practises, presence of quarries, grazing, harvesting regimes etc.).**
Natural	10%	The site is transformed due to historic agricultural activities, straightening of drainage channels and confinement of flow. This has resulted in the incision of the drainage channels and alteration of the surrounding wetland hydrology.
Near Natural (includes areas with low to moderate level of alien invasive plants)	75%	The Goedgevonden wetland has near pristine areas in its upper reaches. Vegetation has been modified to some extent by grazing though. As mentioned above wetland vegetation next to the eastern and western channels has also changed to more ruderal and terrestrial species due to a change in the system's hydrology.

Habitat Condition	Percentage of habitat condition class (adding up to 100%)	Description and additional comments and observations (Incl. additional insight into condition, e.g. poor land management practises, presence of quarries, grazing, harvesting regimes etc.).
Degraded (includes areas heavily invaded by alien plants)	10%	Erosion is occurring in the stream and on surrounding areas of land.
Transformed (includes cultivation, dams, urban, plantation, roads, etc)	5%	Farm homestead and roads along the channels, crossing the main channel at one point.

Complete the table to indicate:

(i) the type of vegetation, including its ecosystem status, present on the site; and
(ii) whether an aquatic ecosystem is present on site.

Terrestrial Ecosystems		**Aquatic Ecosystems**						
Ecosystem threat status as per the NEM:BA (Act No. 10 of 2004)	Critical	**Wetland (including rivers, depressions, channelled and unchannelled wetlands, flats, seeps pans, and artificial wetlands)**			**Estuary**		**Coastline**	
	Endangered							
	Vulnerable							
	Least Threatened	YES	NO	UNSURE	YES	NO	YES	NO

Please provide a description of the vegetation type and/or aquatic ecosystem present on site, including any important biodiversity features/information identified on site (e.g. threatened species and special habitats)

Vegetation: The area is dominated by the Wakkerstroom Montane Grassland vegetation unit. It is classified as "Least threatened" by Mucina and Rutherford (2006). According to Mucina and Rutherford (2006) the vegetation unit consists mostly of short Montane grass on plateaus and flatter areas with short forest and *Leurcosidea* thicket occurring on steep, eastern facing slopes. *L. sericea* is mentioned as the predominant woody pioneer species which invades areas subjected to overgrazing.

Aquatic ecosystem: The Goedgevonden wetland forms part of a larger wetland system (which forms the upper catches of the KwaNtombe River) and is considered critical in terms of habitat provision for wetland dependent species, including the Wattled Crane.

The Goedgevonden wetland further falls within a sub-quaternary catchment classified as a Fish Fresh Water Ecosystem Priority Area. The sub-catchment's rivers are classified as generally intact and in a good condition. It also forms part of a Wetland Fresh Water Ecosystem Priority Area.

An area with peat characteristics furthermore exists in the upper reaches of the Goedgevonden wetland area (***although no work within the peat area will occur***).

5.2.10 Site Photos

	
Landscape photo of the Goedgevonden wetland looking in a southerly direction	Western part of the wetland
	
Eastern part of the wetland	Existing berm, eastern channel, looking north
	
Headcut erosion, main channel, looking south	Road through eastern channel, looking north

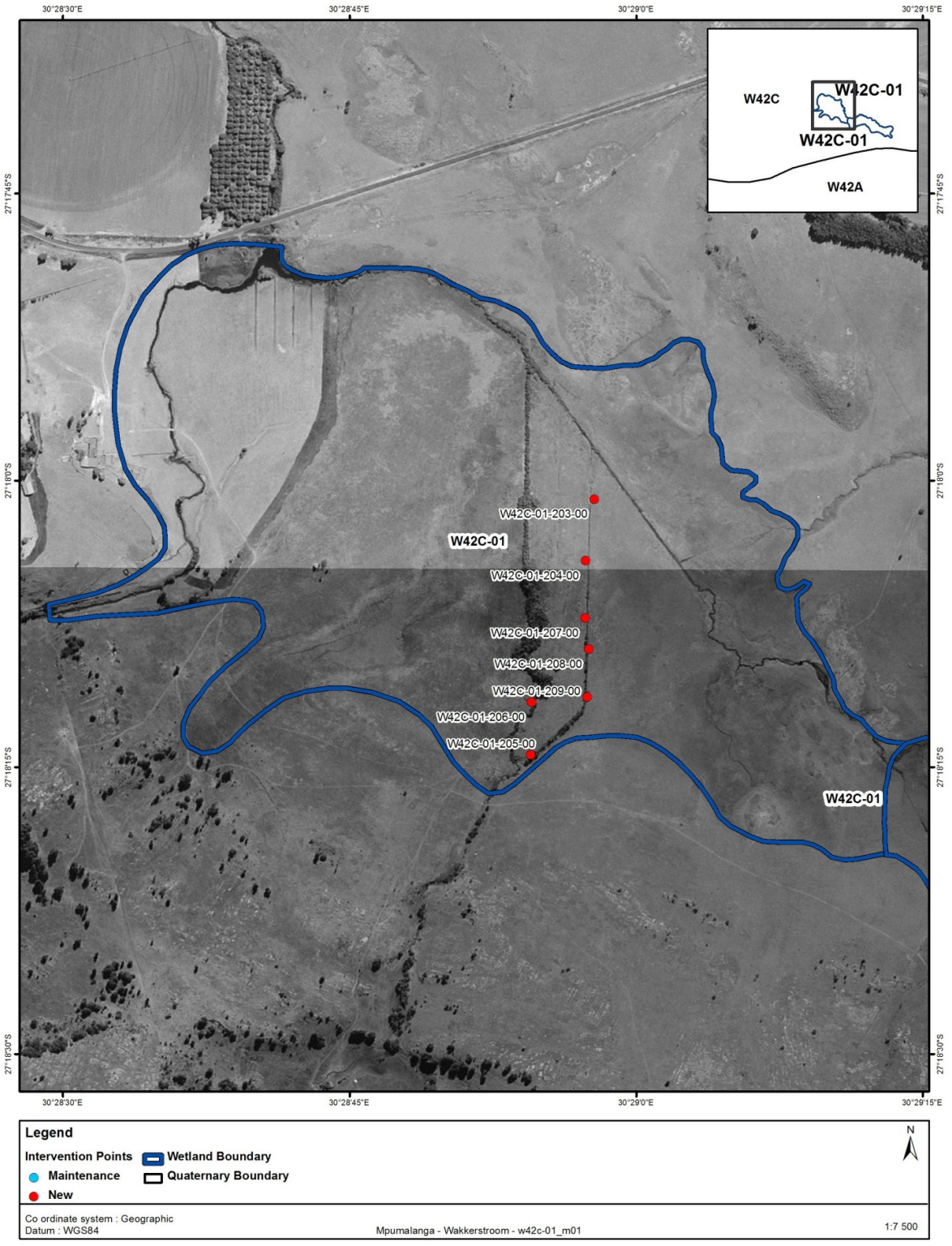


Figure 7: Wetland map, W42C-01 with proposed new wetland interventions indicated.

5.3 Wetland Rehabilitation Problems

The wetland has been subjected to a number of impacts associated with the modification of the system's hydrology, which was likely to have been initiated to allow livestock access for grazing within the valley bottom. The confinement of flow within drainage channels and the straightening of the channel in the lower reaches of the wetland have resulted in the incision of the channels, especially the channel taking flows from the southern tributary. The incision of the channels has resulted in further impact on the system's hydrology, with the desiccation of the adjacent wetland habitat. The alteration of the system's hydrology has resulted in a change in the wetland vegetation, with more terrestrial and ruderal species present within the wetland.

In the upper reaches of the system the incision of the channel has resulted in the formation of headcut erosion where lateral flow enters the channel. The activity of the headcut identified within the system was considered to be relatively limited due to the presence of a hard plinthite layer within the soil profile and the high organic matter content of the soils.

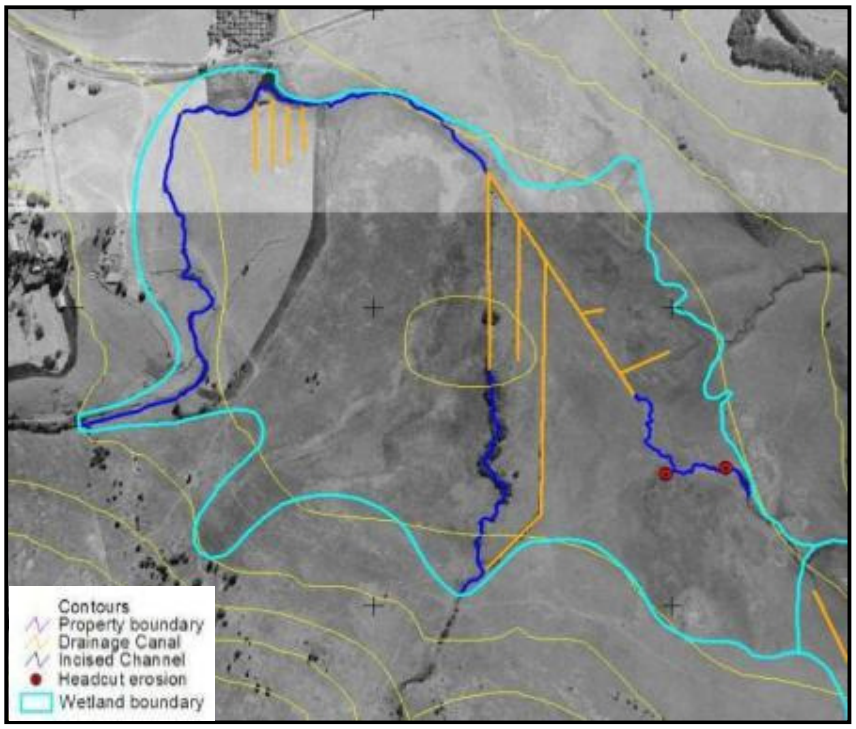


Figure 8: Wetland problems identified.

5.4 Wetland Rehabilitation Objectives

The primary objective of the rehabilitation is to improve the hydrological integrity of the wetland by promoting more diffuse flow through the system, by means of deactivating the incised drainage canals that were historically

excavated throughout the length of the wetland unit. The secondary objective is to prevent further incision of the channel and deactivate the headcut erosion identified within the wetland system.

5.5 Alternatives (section 2(b) in the BAR)

The alternatives have been discussed under each intervention in Section 5.8 below.

5.6 Summary of Existing and Proposed Interventions

The following existing interventions were identified within the wetland:

Table 7: Summary of existing interventions, W42C-01

Intervention Number	Intervention Structure Type	Longitude	Latitude	Estimated maintenance cost
W42C-01-002	Concrete Weir	-27°17'50.35''	30°28'50.56''	R 0
W42C-01-003	Concrete Weir	-27°17'51.78''	30°28'52.32''	R 0
W42C-01-005	Concrete Weir	-27°17'55.71''	30°28'55.71''	R 0
W42C-01-006	Concrete Weir	-27°17'57.96''	30°28'57.21''	R 0
W42C-01-007	Concrete Weir	-27°18'00.20''	30°28'58.80''	R 0
W42C-01-008	Concrete Weir	-27°18'02.01''	30°29'00.16''	R 0
			Total	**R 0**

The following interventions are currently being implemented:

Table 8: Summary of current interventions, W42C-01

Intervention Number	Intervention Structure Type	Longitude	Latitude
W42C-01-014	Gabion weir	-27°18'16.12''	30°29'13.75''
W42C-01-015 (a-e)	Earth berm	-27°18'17.00''	30°29'14.50''
W42C-01-017	Concrete weir	-27°17'54.08''	30°28'54.06''
W42C-01-018	Concrete weir	-27°17'55.80''	30°28'54.05''
W42C-01-019	Concrete weir	-27°17'57.70''	30°28'54.04''

Intervention Number	Intervention Structure Type	Longitude	Latitude
W42C-01-020	Concrete weir	-27°17'59.80''	30°28'54.02''
W42C-01-021	Concrete weir	-27°18'01.80''	30°28'53.90''
W42C-01-022	Concrete weir	-27°18'03.30''	30°28'53.90''
W42C-01-023	Concrete weir	-27°18'00.52''	30°28'53.80''
W42C-01-024	Concrete weir	-27°18'07.70''	30°28'54.10''
W42C-01-025	Gabion weir	-27°17'58.79''	30°28'57.23''

Table 9: Summary of proposed new interventions, W42C-01

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
W42C-01-203-00	Earthen Diversion Berm	5	1	R 22,015.08
W42C-01-204-00	Earthen Diversion Berm	4	1	R 50,454.70
W42C-01-205-00	Reno Matrass	6	2	R 12,196.89
W42C-01-206-00	Gabion Weir	7	2	R 416,400.00
W42C-01-207-00	Gabion Diversion Wall	3	1	R 38,100.85
W42C-01-208-00	Earthen Diversion Berm	2	1	R 67,057.27
W42C-01-209-00	Concrete Diversion Berm	1	1	R 107,970.33
Total				**R 714 195. 12**

The implementation order indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The priority indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

New properties will have to be identified in the next planning cycle. No additional interventions on the existing properties have been identified for the next planning cycle. Wetland Rehabilitation Strategy

These proposed interventions address the wetland problems and achieve the rehabilitation objectives as follows:

- Deactivation of the incised channel and drainage channels to restore the hydrological integrity of the wetland system;
- The implementation of rehabilitation interventions to date is limited to the lower reaches of the system, and is generally associated with the wetland channel rather than the adjacent drainage channels. The proposed rehabilitation would attempt to modify the flow patterns within the upper reaches of the system to promote the more diffuse flow across the western and eastern parts of the wetland as opposed to having flow confined to the incised channel and drainage channels.

5.7 Design Selection and Sizing

The objective of the interventions is to deactivate a drain and spread the water that it would have carried into the surrounding wetlands to the east and west. The most appropriate and cost effective method of doing this was considered to involve:

- The construction of a hard structure (concrete or gabion weir) in the main drain with the spillway set at a level that would allow for the backflooding of an adjoining drain to the east of the main drain. This intervention would also increase the occurrence of overbank topping, particularly into the wetland to the west of the main channel.
- Constructing a combination of concrete, gabion and earthen diversion structures that would divert flows out of the eastern drain and into the wetland to the east. Earthen diversions were specified in areas of low energy and will be vegetated to increase their stability. Concrete and gabion diversion structures were specified where higher energy is expected
- Removal of the existing berm alongside the eastern drain (right hand side) to promote the flow of water into the wetland. Material from the berms should be used for the construction of the in-channel earthen diversion berms
- Excavate the entrance to the eastern drain to allow water to flow towards the eastern side of the wetland
- Install a Reno mattress in-channel liner to ensure that the base level of the eastern drain is set to the desired level.

5.8 Intervention Designs

5.8.1 Intervention: W42C-01-203-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Earthen Diversion Berm
Rehabilitation Objective	To divert flow from the channel onto the adjacent land thereby achieving diffuse flow over the eastern part of the wetland.
Latitude (DºM'S")	27°18'0.99"S
Longitude (DºM'S")	30°28'57.81"E
Engineering Drawings	W42C-01-203-00
Alternatives considered	Gabion and concrete diversion walls. Earth was considered a cost effective solution in the low energy environment

Figure 9: Earthen diversion berm, W42C-01-203-00 looking in a south-westerly direction

5.8.1.1 Bill of quantities: W42C-01-203-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth Structure Volume	m³	26.00	R 793.01	R 20,618.19
Earth Works Volume	m³	2.00	R 698.44	R 1,396.89
			Total	**R 22,015.08**

5.8.1.2 Construction Notes

The diversion is to be constructed at an angle across the channel to divert flows to the right hand side.

General construction notes as set out in **Appendix B** apply, along with all construction notes shown on design drawings.

The following is guidance for working within an area with soils with high organic matter content.

General:

a. Work only in low rainfall periods,
b. Prevent compaction of the soil,
c. Prevent draining, drying and desiccation of soil,
d. Use the general BMP of the WfWet manual for working within wetlands, and
e. Do not bring in any foreign vegetable matter (e.g. mulch) into the wetland area (especially from alien species).

Entering the a wetland:

a. Prevent compaction (and thus potential channelling and erosion) of by not driving into the wetland.
b. However if required to drive into the wetland, then spread the weight of traffic (using walkways, boardwalks, geotextiles etc.). Construction workers and wheelbarrows should use these enforced paths as well.

Excavations (pre-construction):

a. Remove soil in the form of sods (20- 40 x20x20cm)

b. 1st sod layer must include the Rhizome layer (20cm intervals might be a bit too thin for *Phragmites*, but then it might be too difficult to work on thicker sods so keep it at 20cm increments).
c. Cut vegetation short if it will make handling easier. Use cut vegetation as mulch (see next point)
d. Store soil of different layers in different spots (stockpile soils according to the different soil layers as per the soil profile), in order not to mix layers of profile.
e. Cover with mulch or cloth (geotextile) and keep at least 40% moisture If possible, stockpile soils in piles as high as possible (to retain moisture).

Construction – maintain moisture (if work continues into wet season make sure stockpiled soil will not be flooded – removes top rhizome layer at least).

Post-construction

a. Replace sods back into the system in the same order/ layers as to what is naturally occurring (according to the profile).
b. i.e. replace deeper layers 1st with rhizospheres layer on top.
c. Based on type of species make sure the sod is orientated in the original direction in terms of aspect.
d. If sods are not at 90%+ moisture then peg them with wooden stakes.
e. Mulch the site (or use cloth/geotextile).
f. Fence livestock out for at least 2 seasons (or brush pack).
g. If compaction took place then:
    - on flat surfaces, loosen the soil with a fork, and
    - on paths with slopes, put/ create small contour berms.

Draining/pumping

a. If any draining was done during construction, ensure that no preferential flow takes place in the drain after infilling.
b. All decanting points should have energy dissipaters

5.8.2 Intervention: W42C-01-204-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Earthen Diversion Berm
Rehabilitation Objective	To divert flow from the channel onto the adjacent land thereby achieving diffuse flow over the eastern part of the wetland.
Latitude (DºM'S")	27°18'4.21"S
Longitude (DºM'S")	30°28'57.37"E
Engineering Drawings	W42C-01-204-00
Alternatives considered	Gabion and concrete diversion walls were considered. Berm was considered a cost effective solution in the low energy environment

Figure 10: Earthen diversion berm, W42C-01-204-00looking in a south-westerly direction

5.8.2.1 Bill of quantities: W42C-01-204-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth Structure Volume	m³	35.00	R 793.01	R 27,755.25
Earth Works Volume	m³	32.50	R 698.44	R 22,699.45
			Total	**R 50,454.70**

5.8.2.2 Construction Notes:

The diversion is to be constructed at an angle across the channel to divert flows to the east of the channel. Also see Section 5.8.1.2.

5.8.3 Intervention: W42C-01-205-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Reno mattress
Rehabilitation Objective	Channel protect and to set the base level of the eastern channel
Latitude (DºM'S")	27°18'14.36"S
Longitude (DºM'S")	30°28'54.48"E
Engineering Drawings	W42C-01-205-00
Alternatives considered	No alternatives considered. A Reno mattress was selected as it is adaptable to the profile of the channel.

Figure 11: Reno mattress, WC42-01-205-00, looking in an easterly direction

5.8.3.1 Bill of quantities: W42C-01-205-00

Item	Units	Quantity	Unit Cost	Item Cost
6 x 2 x 0.3 Reno Mattress	m^3	1		
Gabion Rock Volume	m^3	3.6	R 3,000.00	R 10,800.00
Earth Works Volume	m^3	2.00	R 698.44	R 1,396.89
			Total	**R 12,196.89**

5.8.3.2 Construction notes

As under Section 5.8.1.2. The top of the Reno mattress is to be constructed 100mm higher than the water in the upstream channel that is backed up from intervention W42C-01-206-00.

5.8.4 Intervention: W42C-01-206-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Gabion Weir and earthen berm
Rehabilitation Objective	To divert flow from the channel onto the adjacent land thereby achieving diffuse flow over the western part of the wetland. The weir is to encourage high flows to enter the eastern drain.
Latitude (DºM'S")	27°18'11.61"S
Longitude (DºM'S")	30°28'54.52"E
Engineering Drawings	W42C-01-206-00
Alternatives considered	A robust impermeable structure was required to withstand the force of the water from the catchment. Earthen material was therefore not considered

Figure 12: Gabion weir wall, W42C-01-206-00 looking in a south-easterly direction

Figure 13: Berm, W42C-01-206-00 looking in a north-westerly direction

5.8.4.1 Bill of quantities: W42C-01-206-00

Item	Units	Quantity	Unit Cost	Item Cost
1.5 x 1 x 1 Gabion Basket	Baskets	18		
2 x 1 x 1 Gabion Basket	Baskets	2		
3 x 1 x 1 Gabion Basket	Baskets	16		
4 x 1 x 1 Gabion Basket	Baskets	4		
3 x 1 x 0.5 Gabion Basket	Baskets	2		
4 x 1 x 0.5 Gabion Basket	Baskets	3		
2 x 1 x 0.3 Gabion Basket	Baskets	7		
3 x 1 x 0.3 Gabion Basket	Baskets	10		
6 x 2 x 0.3 Gabion Basket	Baskets	6		
Earth Works Volume	m³	150		
Gabion Rock Volume	m³	138.8	R 3,000.00	R 416,400.00
Geotextile	m²	110		
Plastic Sheet	m²	44		
			Total	**R 416,400**

5.8.4.2 Construction notes

Refer to Section 5.8.1.2

5.8.5 Intervention W42C-01-207-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Gabion Diversion Berm
Rehabilitation Objective	To divert flow from the channel onto the adjacent land thereby achieving diffuse flow over the eastern part of the wetland.
Latitude (DºM'S")	27°18'7.21"S
Longitude (DºM'S")	30°28'57.34"E
Engineering Drawings	W42C-01-207-00
Alternatives considered	Gabions were specified as a robust structure is required to handle higher energy in the system in the event of the upstream earthen diversion berm failing.

Figure 14: Gabion diversion wall, W42C-01-207-00, looking in a south-easterly direction

5.8.5.2 Bill of quantities: W42C-01-207-00

Item	Units	Quantity	Unit Cost	Item Cost	Estimated Labour Budget %	Labour budget
Earth Structure Volume	m³	41.00	R 793.01	R 32,513.30		
Earth Works Volume	m³	8.00	R 698.44	R 5,587.56		
Total				**R 38,100.85**		

5.8.5.3 Construction notes

The diversion is to be constructed at an angle across the channel to divert flows to the right hand side

5.8.7 Intervention W42C-01-208-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Earthen Diversion Berm
Rehabilitation Objective	To divert flow from the channel onto the adjacent land thereby achieving diffuse flow over the eastern part of the wetland.
Latitude (DºM'S")	27°18'8.84"S
Longitude (DºM'S")	30°28'57.52"E
Engineering Drawings	W42C-01-208-00
Alternatives considered	Earth was specified as the bulk of the flows will be diverted by the upstream concrete diversion wall. An earthen diversion was considered a cost effective option

Figure 15: Earthen diversion berm, W42C-01-208-00 looking in a north-westerly direction

5.8.7.1 Bill of quantities: W42C-01-208-00

Item	Units	Quantity	Unit Cost	Item Cost	Estimated Labour Budget %	Labour budget
Earth Structure Volume	m³	37.00	R 793.01	R 29,341.27		
Earth Works Volume	m³	54.00	R 698.44	R 37,716.01		
Total				**R 67,057.27**		

5.8.7.2 Construction notes:

The diversion is to be constructed at an angle across the channel to divert flows to the right hand side

Refer to Section 5.8.1.2

5.8.8 Intervention W42C-01-209-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Concrete Diversion Berm
Rehabilitation Objective	To divert flow from the channel onto the adjacent land thereby achieving diffuse flow over the eastern part of the wetland.
Latitude (DºM'S")	27°18'11.34"S
Longitude (DºM'S")	30°28'57.44"E
Engineering Drawings	W42C-01-209-00
Alternatives considered	The intervention will be receiving the full force of water in the drain and an earthen berm was therefore not considered.

Figure 16: Concrete diversion wall, W42C-01-209-00 looking in a north-westerly direction

5.8.8.1 Bill of quantities: W42C-01-209-00

Item	Units	Quantity	Unit Cost	Item Cost	Estimated Labour Budget %	Labour budget
Concrete: 20 MPa	m³	10	R 6,606.37	R 66,063.65		

Item	Units	Quantity	Unit Cost	Item Cost	Estimated Labour Budget %	Labour budget
Cement	Pockets	68				
Sand	m³	6.5				
Stone	m³	7				
Earth Works Volume	m³	60	R 698.44	R 41,906.68		
Weldmesh Ref 617	m²	63				
Mass of Steel	kg	95				
Concrete: 20 MPa	m³	10	R 6,606.37	R 66,063.65		
Total				**R 107,970.33**		

5.8.8.2 Construction notes:

The concrete wall is to have a 500mm freeboard and is to be constructed at an angle across the channel to divert flows to the right hand side

5.9 Construction Environmental Management Plan Issues

The proposed rehabilitation is to be undertaken on privately owned land and the project team should access the site and manage the site in accordance with the WfWet best management practices and specific requirements of the land owner. The implementation of these interventions must also take into account all relevant provisions of Working for Wetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the Basic Assessments submitted for Environmental Authorisation and the requirements of the Environmental Authorisation Record of Decision for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as Appendix B and F.

The following project-specific management issues apply:

- The wetland is located directly downstream from a relatively pristine peatland system that provides breeding habitat for a pair of endangered Wattled Crane. The Working for Wetlands team's movements and activities are planned to be limited to the Goedgevonden Farm, limiting the potential for disturbance of the nesting pair of cranes, especially as construction is likely to coincide with the breeding period.
- The portion of the incised channel that is dominated by woody species is characterised by the presence of various sizes of tree ferns that would need to be safely removed and relocated into sections of the riparian habitat upstream of the wetland. This would need to be undertaken in consultation with Mpumalanga Parks and Tourism Agency to ensure survival of these plants.
- The area generally provides habitat for a number of Red Data species and the construction activities should be planned and managed to reduce impacts on the fauna and flora in the area in accordance with WfWet best management practices and with input from the land owner and local conservation organisations.

5.10 Wetland Management Recommendations

The system is currently utilised for livestock grazing, but following the implementation of the rehabilitation activities the system may become inaccessible for livestock. The landowner should consider fencing the wetland and managing livestock access to limit grazing to the winter months.

5.11 Baseline M&E Data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

5.11.1.1 Erosion Problems

The erosional features within the wetland are generally limited to channel incision and are relatively stable, and will therefore not be monitored specifically. If these features were to become unstable at any point, monitoring should be undertaken.

5.11.1.2 Fixed Point Photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

Locations

FPP Number	01	
GPS Location (DMS)	Latitude	27°17'48.45"S
	Longitude	30°29'04.66"E
Description of Photography Point		
Fixed point photograph taken from a ridge opposite the wetland, adjacent to a small tree.		

Photographs

Description of the features within the photographs
View of the Goedgevonden wetland looking in a southerly direction.

5.11.1.3 Baseline WET-Health Data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to APPENDIX A):

HGM Unit	**Area (ha)**	**Hydro Health**	**Geo Health**	**Vegetation Health**
2008 assessment	66.00	4.0	8.4	7.0

6. PAARDEPLAATS WETLAND –W42C-02

The landowner of Goedgevonden also owns land on adjacent properties within the same catchment and it was therefore decided to extend the work onto this property, especially considering the recent proclamation of the KwaMandlangampisi Protected Environment.

The 2011/2012 Rehabilitation Plan included alien clearing, follow up spraying of alien vegetation and the re-seeding of areas previously cleared by the landowner. The project had been aligned with the extent of the National Grasslands Biodiversity Programme's (NGBP) demonstration area in the Wakkerstroom/Luneburg area and falls within the newly proclaimed KwaMandlangampisi Protected Environment.

Work for the 2012/2013 planning cycle primarily includes the rehabilitation of two badly eroded dirt roads (hereafter referred to as Road A and Road B) on the farm. In addition the following interventions were identified on site during the site visit in August 2012:

- a section of an access road will be stabilised by protecting it from headcut erosion and constructing concrete strips over the affected area
- rehabilitation of an area affected by hillslope failure
- rehabilitation of two erosion ditches next to one of the roads
- rehabilitation of a seep/wetland area which is drained by a ditch and also used by cattle as a watering point.

The following new interventions are therefore proposed for the selected areas.

Table 10: Summary of new interventions, W42C-02

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Cost (Excl. Vat)
W42C-02-208-00	Gabions Diversion Wall and Earthen Berms with seeding and biojute	20	4	**R 1,290,084.32**
W42C-02-209-00	Concrete strips and gabion protection	18	3	**R 44,425.46**
W42C-02-210-00	Revegetation of hillslope	19	4	**R 71,241.35**
W42C-02-211-00	Rockpacks	16	4	**R 400,650.74**
W42C-02-212-00	Rockpacks	17	4	**R 254,037.44**
W42C-02-213-00	Surface cross drain	11	4	**R 27,379.03**
W42C-02-214-00	Revegetation	15	4	**R 13,968.89**

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Cost (Excl. Vat)
W42C-02-215-00	Rockpacks	12	4	**R 723,730.79**
W42C-02-216-00	Gully stabilisation	7	4	**R 325,202.71**
W42C-02-217-00	Surface cross drains, gabion diversion walls and earthen berms	8	4	**R 124,911.22**
W42C-02-218-00	Concrete strips and backfill trench	2	3	**R 66,441.73**
W42C-02-219-00	Concrete weir	1	2	**R 269,934.21**
W42C-02-220-00	Surface Cross Drain	9	4	**R 35,934.97**
W42C-02-221-00	Surface Cross Drain	10	4	**R 15,400.70**
W42C-02-222-00	Surface Cross Drain	3	4	**R 8,555.95**
W42C-02-223-00	Surface Cross Drain	4	4	**R 6,844.76**
W42C-02-224-00	Surface Cross Drain	5	4	**R 5,133.57**
W42C-02-225-00	Surface Cross Drain	6	4	**R 23,956.65**
W42C-02-226-00	Surface Cross Drain	14	4	**R 54,758.06**
W42C-02-227-00	Surface Cross Drain	13	4	**R 41,068.54**
Total				**R 3 871 759.44**

The implementation order indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The priority indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

6.1 Wetland Details

Wetland Name	Paardeplaats
Wetland Number	W42C-02
River System Name	Upper reaches of KwaNtombe River
Land Use in Catchment	Livestock Farming, crop production
Land Use in Wetland	Protected area (KwaMandlangampisi Protected Environment). Farmer renting property from Mpumalanga Tourism and Parks Agency for livestock farming
No. of Properties Intersecting Wetland Area	1
Date of Wetland Assessment	15 August 2012– Rapid Wet Tools Assessment
Wetland Assessor(s)	Brad Graves
Wetland size	0.61ha

Biophysical characteristics of the wetland

6.1.1 Gradient of the site (section B1 of the BAR)

Flat	1:50 – 1:20	1:20 – 1:15	1:15 – 1:10	1:10 – 1:7,5	1:7,5 – 1:5	Steeper than 1:5

6.1.2 Location in landscape (section B2 of the BAR)

Indicate the landform(s) that best describes the site:

Ridgeline		Closed valley		Undulating plain / low hills			
Plateau		Open valley		Dune			
Side slope of hill/mountain	X	Plain		Seafront			

6.1.4 Groundwater, soil and geological stability of the site (section B3 of the BAR)

Is the site(s) located on any of the following?

	Alternative S1:	
Shallow water table (less than 1.5m deep)	YES	
Dolomite, sinkhole or doline areas		NO
Seasonally wet soils (often close to water bodies)	YES	
Unstable rocky slopes or steep slopes with loose soil		NO
Dispersive soils (soils that dissolve in water)		NO
Soils with high clay content (clay fraction more than 40%)	YES	
Any other unstable soil or geological feature	YES	
An area sensitive to erosion	YES	

6.1.5 Groundcover (section B4 of the BAR)

Alternative S1:

Natural veld - good condition[E]	Natural veld with scattered aliens[E]	Natural veld with heavy alien infestation[E]	Veld dominated by alien species[E]	Gardens
Sport field	Cultivated land	Paved surface	Building or other structure	Bare soil

If any of the boxes marked with an "[E] "is ticked, please consult an appropriate specialist to assist in the completion of this section if the environmental assessment practitioner doesn't have the necessary expertise.

Has a specialist been consulted?		NO

Wetland ecologist, Craig Cowden/Bradley Graves, did the wetland assessment which included present ecological condition.

Species of special concern known to occur in the quaternary catchment:

- Wattle Crane (*Bugeranus carunculatus*) – Critically endangered

6.1.6 Surface water (section B5 of the BAR)

Indicate the surface water present on and or adjacent to the site and alternative sites?

Perennial River	YES	NO	UNSURE
Non-Perennial River	YES	NO	UNSURE
Permanent Wetland	YES	NO	UNSURE
Seasonal Wetland	YES	NO	UNSURE
Artificial Wetland	YES	NO	UNSURE
Estuarine / Lagoonal wetland	YES	NO	UNSURE

If any of the boxes marked YES or UNSURE is ticked, please provide a description of the relevant watercourse.

The purpose of the Working for Wetland's project is wetland conservation and indirectly the protection of biodiversity and South Africa's water resources. The proposed wetland rehabilitation interventions are located in and around a seep area on an east facing hillside slope. The seep/wetland area is dissected by a dirt road and the seep is drained by an artificial drainage ditch in order to keep the road dry. Water from the ditch is conveyed via a pipe underneath the road where it is released into the surrounding grassland, leading to a wetland area downhill of the road.

6.1.7 Land use character of surrounding area (section B6 of the BAR)

Indicate land uses and/or prominent features that currently occur within a 500m radius of the site and give description of how this influences the application or may be impacted upon by the application:

Natural area	Dam or reservoir	Polo fields
Low density residential	Hospital/medical centre	Filling station[H]
Medium density residential	School	Landfill or waste treatment site
High density residential	Tertiary education facility	Plantation
Informal residential[A]	Church	Agriculture
Retail commercial & warehousing	Old age home	River, stream or wetland

Light industrial	Sewage treatment plant[A]	Nature conservation area
Medium industrial[AN]	Train station or shunting yard[N]	Mountain, koppie or ridge
Heavy industrial[AN]	Railway line[N]	Museum
Power station	Major road (4 lanes or more)[N]	Historical building
Office/consulting room	Airport[N]	Protected Area
Military or police base/station/compound	Harbour	Graveyard
Spoil heap or slimes dam[A]	Sport facilities	Archaeological site
Quarry, sand or borrow pit	Golf course	Other land uses (describe)

If any of the boxes marked with an "[N] "are ticked, how will this impact / be impacted upon by the proposed activity?

N/A

If any of the boxes marked with an "[An]" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

N/A

If any of the boxes marked with an "[H]" are ticked, how will this impact / be impacted upon by the proposed activity? Specify and explain:

N/A

Does the proposed site (including any alternative sites) fall within any of the following:

Critical Biodiversity Area (as per provincial conservation plan)	YES	NO
Core area of a protected area?	YES	NO
Buffer area of a protected area?	YES	NO
Planned expansion area of an existing protected area?	YES	NO
Existing offset area associated with a previous Environmental Authorisation?	YES	NO

6.1.8 Cultural or historical features (section B7 of the BAR)

Are there any signs of culturally or historically significant elements, as defined in section 2 of the National Heritage Resources Act, 1999, (Act No. 25 of 1999), including Archaeological or paleontological sites, on or close (within 20m) to the site? If YES, explain:	YES	NO
	Uncertain	

N/A

If uncertain, conduct a specialist investigation by a recognised specialist in the field (archaeology or palaeontology) to establish whether there is such a feature(s) present on or close to the site. Briefly explain the findings of the specialist:

Not Applicable – A copy of the 2012 Wakkerstroom BAR and Rehabilitation Plan will however be provided to the relevant heritage authorities for consideration.

Will any building or structure older than 60 years be affected in any way?	YES	NO
Is it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)?	YES	NO

If YES, please provide proof that this permit application has been submitted to SAHRA or the relevant provincial authority.

6.1.9 Biodiversity (Section B9 of the BAR)

Indicate the applicable biodiversity planning categories of all areas on site and indicate the reason(s) provided in the biodiversity plan for the selection of the specific area as part of the specific category)

Systematic Biodiversity Planning Category				**If CBA or ESA, indicate the reason(s) for its selection in biodiversity plan**
Critical Biodiversity Area (CBA)	**Ecological Support Area (ESA)[7]**	**Other Natural Area (ONA)**	**No Natural Area Remaining (NNR)**	The Paardeplaats farm forms part of the KwaMandlangampisi Protected Environment area, which was the first protected area of its sort in South Africa. According to the World Wildlife Fund (2010) the KwaMandlangampisi Protected Environment it is a critical water catchment area for South Africa that includes the headwaters of the Pongola River and the Assegaai River, which feeds the Heyshope Dam and provides clean water for national power generation. it spans threatened high altitude grasslands, wetlands and indigenous Mistbelt forest, and is home to threatened and endemic plant, bird and animal species, including the Oribi and South Africa's three Crane species (Wattled, Grey Crowned and Blue).

Indicate and describe the habitat condition on site

Habitat Condition	**Percentage of habitat condition class (adding up to 100%)**	**Description and additional comments and observations (Incl. additional insight into condition, e.g. poor land management practises, presence of quarries, grazing, harvesting regimes etc.).**
Natural	10%	The surrounding area is mostly in a near natural state, parts of the surrounding environment is however not impacted by grazing or historic land uses and can therefore be classified as completely "natural".

[7] Ecological Support Areas are supporting zones required to prevent the degradation of Critical Biodiversity Areas and Protected Areas. These may include areas that are degraded or even transformed if these areas still play an important role in supporting CBAs (e.g. heavily invaded riparian strips or farmland within a coastal corridor).

Habitat Condition	Percentage of habitat condition class (adding up to 100%)	Description and additional comments and observations (Incl. additional insight into condition, e.g. poor land management practises, presence of quarries, grazing, harvesting regimes etc.).
Near Natural (includes areas with low to moderate level of alien invasive plants)	80%	Most of the surrounding area is impacted to some extent by cattle grazing in the area as well as erosion. Large areas can however be classified as very close to "natural".
Degraded (includes areas heavily invaded by alien plants)	5%	Headcut erosion is occurring at the seep area. The seep area is further impacted by cattle using it as a watering point and a drainage ditch draining water from the seep.
Transformed (includes cultivation, dams, urban, plantation, roads, etc.)	5%	Various eroded dirt roads are present on the farm. The seep/wetland area is also dissected by a dirt road (Road B).

Complete the table to indicate:

(iii) the type of vegetation, including its ecosystem status, present on the site; and

(iv) whether an aquatic ecosystem is present on site.

<table>
<tr><th colspan="2">Terrestrial Ecosystems</th><th colspan="5">Aquatic Ecosystems</th></tr>
<tr><td rowspan="4">Ecosystem threat status as per the NEM:BA (Act No. 10 of 2004)</td><td>Critical</td><td colspan="3" rowspan="2">Wetland (including rivers, depressions, channelled and unchannelled wetlands, flats, seeps pans, and artificial wetlands)</td><td colspan="2" rowspan="2">Estuary</td><td colspan="2" rowspan="2">Coastline</td></tr>
<tr><td>Endangered</td></tr>
<tr><td>Vulnerable</td><td colspan="3" rowspan="2"></td><td colspan="2" rowspan="2"></td><td colspan="2" rowspan="2"></td></tr>
<tr><td rowspan="2">Least Threatened</td></tr>
<tr><td>YES</td><td>NO</td><td>UNSURE</td><td>YES</td><td>NO</td><td>YES</td><td>NO</td></tr>
</table>

Please provide a description of the vegetation type and/or aquatic ecosystem present on site, including any important biodiversity features/information identified on site (e.g. threatened species and special habitats)

Vegetation: The area is dominated by the Wakkerstroom Montane Grassland vegetation unit. It is classified as "Least threatened" by Mucina and Rutherford (2006). According to Mucina and Rutherford (2006) the vegetation unit consists mostly of short Montane grass on plateaus and flatter areas with short forest and *Leurcosidea* thicket occurring on steep, eastern facing slopes. *L. sericea* is mentioned as the predominant woody pioneer species which invades areas subjected to overgrazing.

A small patch of Paulpietersburg Moist Grassland occurs on the eastern parts of the farm. The seep/wetland area falls in this vegetation unit. It is classified as "Vulnerable" by Mucina and Rutherford (2006) with only a small portion being statutorily conserved.

Small patches of Northern KwaZulu-Natal Mistbelt Forest also occur on the Paardeplaats farm. This vegetation unit is described as "least threatened" in Mucina and Rutherford (2006). None of the proposed intervention will occur in or close to these forest patches.

Aquatic ecosystem: The Paardeplaats farm forms part of the upper reaches of the KwaNtombe River and greater Pongola River catchment area with various smaller streams draining the farm. These streams flow in a north-easterly direction towards the KwaNtombe River, which is about 4KM downstream of the north-eastern boundary of the farm.

The farm further falls within a sub-quaternary catchment classified as a Fish Fresh Water Ecosystem Priority Area. The sub-catchment's rivers are classified as generally intact and in a good condition. It's also forms part of a Wetland Fresh Water Ecosystem Priority Area.

6.1.10 Site Photos

	
Headcut erosion to be stabilised by gabion baskets looking in a north-westerly direction (Intervention W42-02-209-00)	Road to be stabilised by means of concrete strips. Looking in a northern direction(Intervention W42-02-209-00)
	
Hillslope failure identified for contouring and rehabilitation looking in a south-westerly direction (Intervention W42C-02-2010-00)	Erosion next to road looking in a south-easterly direction to be stabilised by rockpacks (Intervention W42C-02-210-00)
	
Road to be protected by surface cross drains looking in a south-easterly direction (Intervention W42C-02-213-00, W42C-02-226-00 and W42C-02-227-00)	Seep area looking in a north-westerly direction (Intervention W42C-02-219-00)

	
Pipe used to drain water onto the surrounding field (Interventions W42C-02-218-00 and W42C-02-219-00)	Wetland area looking in an easterly direction (Interventions W42C-02-218-00 and W42C-02-219-00)
	
Section of road next to the seep area to be protected by concrete strips thereby also protecting further degradation of the seep/wetland area (Interventions W42C-02-218-00 and W42C-02-219-00)	Road to be decommissioned and rehabilitated looking in a north-easterly direction (W42C-02-208-00)
	
Road to be decommissioned and rehabilitated looking in an easterly direction (W42C-02-208-00)	

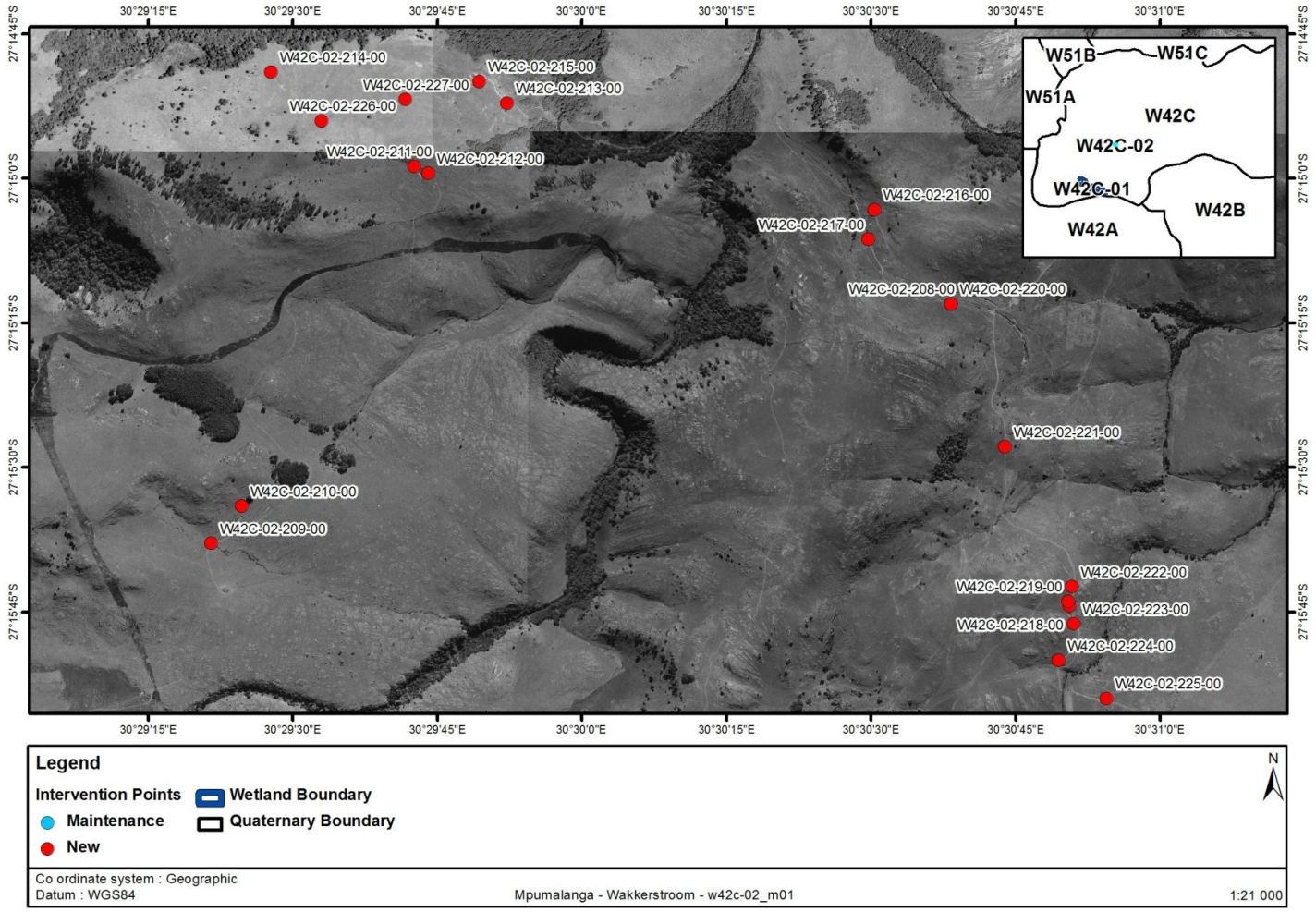


Figure 17: Wetland map, W42C-01 with proposed new wetland interventions indicated.

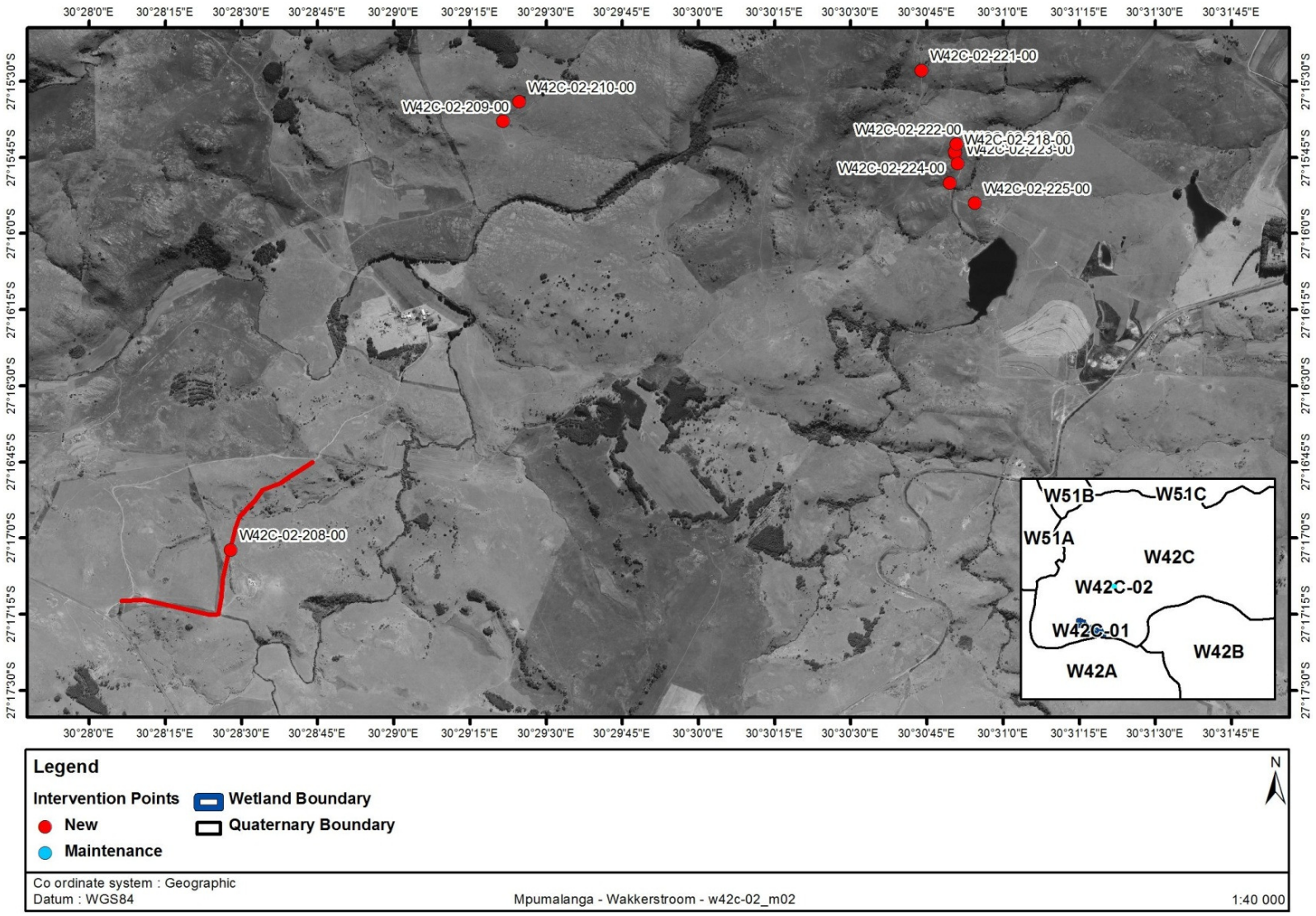


Figure 18: Wetland map, W42C-01 with proposed new wetland interventions indicated.

6.1.11 Wetland Rehabilitation Problems

The biophysical drivers of the wetland have been impacted upon by various activities, including inter alia:

- construction of an access road through the wetland;
- the diversion of flow by a trench adjacent to the road; and
- the use of the seep area as a watering point by cattle.

The upper portion of the wetland has been subjected to a number of impacts associated with the modification of the system's hydrology, which was likely to have been initiated to allow for the access across the wetland (see Figure 19 below). The problems identified within the wetland system can be addressed with the implementation of rehabilitation activities, which would include the deactivation of the headcut and trench, and the construction of concrete strips to stabilise the existing road/tracks.

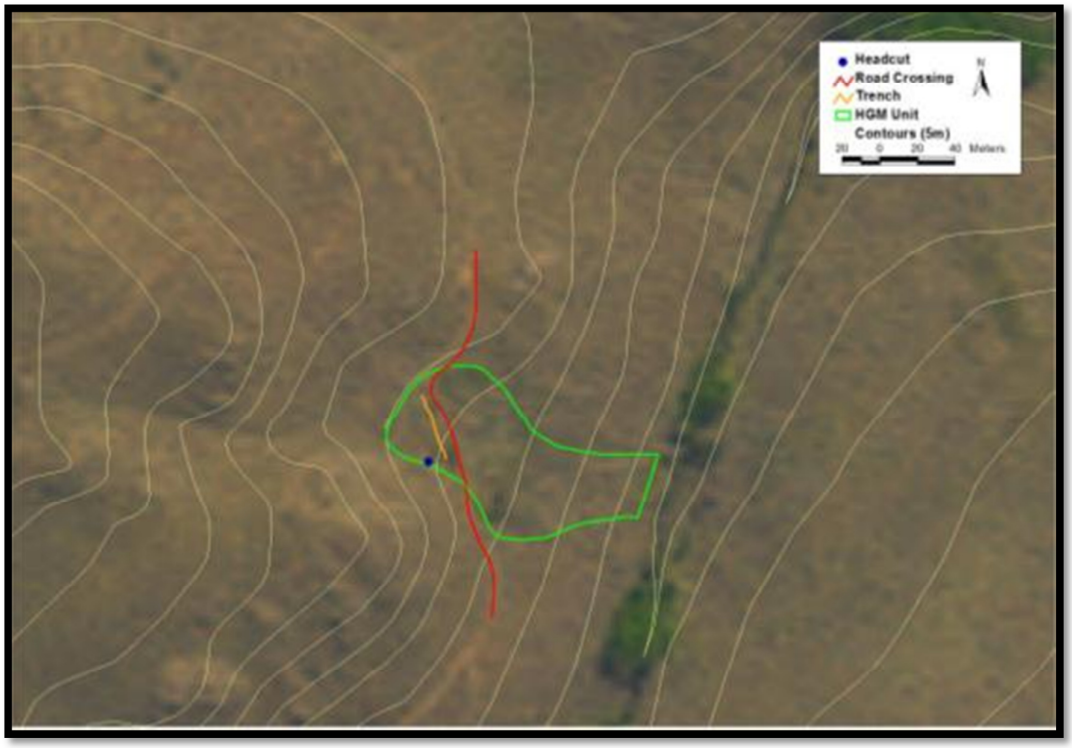


Figure 19: Wetland problems identified within wetland W42C-02

6.1.12 Wetland Rehabilitation Objectives

The primary objectives of the rehabilitation are as follows:

- reduce the threat to the seep/wetland area by headcut erosion;
- promoting diffuse flow;
- reduce further impacts from thoroughfare travelling along the road; and
- protecting the wetland from cattle using it as a watering point.

6.1.13 Alternatives (section 2(b) in the BAR)

Alternatives for each of the interventions are detailed in the various sections of Section 6.4.

6.1.14 Summary of Existing and Proposed Interventions

No existing interventions are present on the Paardeplaats farm. The following interventions are currently being implemented/were implemented during the 2011/2012 planning cycle:

Table 11: Summary of current interventions, W42C-02

Intervention Number	Intervention Structure Type	Longitude	Latitude
W42C-02-201-00	Re-seeding	30°31'01.43"E	27°14'18.69"S
W42C-02-202-00	Re-seeding	30°30'52.24"E	27°14'47.37"S
W42C-02-203-00	Follow up spraying - wattle	30°29'55.75"E	27°14'53.93"S
W42C-02-204-00	Follow up spraying – wattle & bugweed	30°29'11.55"E	27°14'44.02"S
W42C-02-205-00	Follow up spraying - wattle	30°28'56.90"E	27°14'56.90"E
W42C-02-206-00	Follow up spraying - wattle	30°28'49.14"E	27°15'2.24"S
W42C-02-207-00	Cut and frill – wattle and follow up spraying.	30°30'02.63"E	27°15'27.09"S

The following new interventions are proposed for the Paardeplaats farm.

Table 12: Summary of proposed new interventions, W42C-02

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
W42C-02-208-00	Deactivation of old road using gabions, diversion berms and grass seeding	20	4	**R 1,290,084.32**
W42C-02-209-00	Concrete strips and gabion cut off wall	18	3	**R 44,425.46**
W42C-02-210-00	Rehabilitation of hillslope erosion with grass seeds, erosion control blankets, water deflection berms and alien plant clearing	19	4	**R 71,241.35**
W42C-02-211-00	Contouring and rehabilitation of erosion ditches next to road with rock packs	16	4	**R 400,650.74**
W42C-02-212-00	Contouring and rehabilitation of erosion ditches next to road with rock packs	17	4	**R 254,037.44**
W42C-02-213-00	Surface cross drains to protect steep section of road	11	4	**R 27,379.03**
W42C-02-214-00	Rehabilitation of hillslope erosion with grass seeds, erosion control blankets and water deflection berms	15	4	**R 13,968.89**
W42C-02-215-00	Rehabilitation of erosion ditches next to road with rock packs	12	4	**R 723,730.79**
W42C-02-216-00	Gully stabilisation with rockpacks and gabion diversion walls	7	4	**R 325,202.71**
W42C-02-217-00	Deactivate old road (gabion walls and earthen diversion berms) and protect new road (surface cross drains)	8	4	**R 124,911.22**

Intervention Number	Intervention Structure Type	Implementation Order	Priority	Structure Cost (Excl. Vat)
W42C-02-218-00	Concrete strips, backfilling of trench and fencing to protect the sensitive area	2	3	**R 66,441.73**
W42C-02-219-00	Deactivate headcut erosion through construction of concrete weir	1	2	**R 269,934.21**
W42C-02-220-00	Surface cross drain	9	4	**R 35,934.97**
W42C-02-221-00	Surface cross drain	10	4	**R 15,400.70**
W42C-02-222-00	Surface cross drain	3	4	**R 8,555.95**
W42C-02-223-00	Surface cross drain	4	4	**R 6,844.76**
W42C-02-224-00	Surface cross drain	5	4	**R 5,133.57**
W42C-02-225-00	Surface cross drain	6	4	**R 23,956.65**
W42C-02-226-00	Surface cross drain	14	4	**R 54,758.06**
W42C-02-227-00	Surface cross drain	13	4	**R 41,068.54**
Total				**R 3 871 759.44**

The implementation order indicates the timing order in which interventions should be implemented within the wetland (number 1 first). The priority indicates the relative importance of each intervention across the project as a whole – if interventions have to be omitted for any reason, those with the lowest priority (highest number) across the whole project should be omitted first.

New properties will be identified in the next planning cycle. No future interventions are planned on Paardeplaats.

6.2 Wetland Rehabilitation Strategy

These proposed interventions address the wetland problems and achieve the rehabilitation objectives as follows:

- reduce the threat to the seep/wetland area by stabilising the headcut erosion;
- promoting diffuse flow by deactivating a drainage ditch next to the road;
- installing concrete strips to reduce further impacts from thoroughfare travelling along the road; and
- protecting the wetland by fencing off the area from cattle using it as a watering point.

6.3 Design Selection and Sizing

The objectives of the interventions are to deactivate headcut erosion, stabilise hillslope erosion and erosion gullies, alien plant clearing, protect sensitive wet areas from degradation by traffic and livestock, close and deactivate old roads and protect the steep sections of the existing roads with surface cross drains.

The most appropriate and cost effective method of achieving the objectives was considered in each case. Where possible, the available materials on site (e.g. rocks for rockpacks and earth material for earthen berms) were utilised in the designs. Concrete was considered to be the most appropriate material for the headcut stabilisation structure as it will be impermeable and long lasting. Gabions were specified in the erosion gullies where it was anticipated that flows would damage rock packs.

All the interventions were sized according to dimensions of the problems that were measures on site.

6.4 Interventions Designs

6.4.1 Intervention: W42C-02-208-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Rehabilitate old road with a series of gabion and earthen deflection structures, sloping of vertical banks and grass seeding
Rehabilitation Objective	Decommission old road
Latitude (DºM'S")	Linear feature
Longitude (DºM'S")	Linear feature
Engineering Drawings	W42C-02-208-00
Alternatives Considered	No alternatives were considered. Gabions were specified on the steeper areas in order to break the energy of the surface runoff. Earthen diversion berms were specified in the low energy environments. Gabions were better suited to the site conditions than concrete

Figure 20: Old road requiring closure and rehabilitation (Intervention W42C-02-208-00)

6.4.1.1 Bill of quantities: W42C-02-208-00

Item	Units	Quantity	Unit Cost	Item Cost
3 x 1 x 1 Gabion Basket	m³	9		
4 x 1 x 1 Gabion Basket	m³	18		
Earth Structure Volume	m³	900	R 793.01	R 713,706

Item	Units	Quantity	Unit Cost	Item Cost
Gabion Rock Volume	m³	99	R 3,000.00	R 297,000.00
Earth Works Volume	m³	400	R 698.44	R 279,377.84
Seeding and Biojute	m²	1420		
			Total	**R 1,290,084.32**

6.4.1.2 Construction Notes:

The steep approaches to the stream are to be rehabilitated by alternating gabion deflection walls and earthen berms. The remaining sections are to be rehabilitated with earthen berms to deflect water off the road. The berms are to be at least 500mm higher than the natural ground level on the lower side where the water is discharging and have crest widths of 0.5m (side slopes of 1 in 2). Vertical banks are to be sloped to 1 in 2 slopes to promote the establishment of vegetation. The flatter bare areas are to be loosened to 100mm, apply kraal manure, seed and biojute. Quantities are as follows: 9 Gabions walls (each wall is 11x1x1): 270 square meters of geofabric; 28 earthen berms (901 cubic meters); slope banks (400 cubic meters); seeding and biojute (1420 square meters)

Standards revegetation specifications:

The bare areas (3 of) are to be rehabilitated by constructing diversion berms (to divert surface runoff off the eroding area: berms approximately 500mm high, 500mm crest width and 1 in 2 side slopes) diagonally across the bare areas at approximately 7m intervals, loosen the surface material to a depth of 100mm, apply kraal manure, grass seed and apply biojute as per suppliers specification. The emerging wattle saplings in the area are to be hand pulled.

SOIL PREPARATION

It is generally recommended that soil samples be collected and analysed by an agricultural laboratory to determine the need for site specific supplementary fertilizing. This is especially necessary for areas cleared from Wattles.

In instances where soils sampling could not be done, soil should be prepared by applying 50kg 2:3:2 per ha or alternatively provide a good spread of "kraalmanure". Care should be taken that manure used is not contaminated with other alien invasive species.

The fertilizer must be applied by hand on the identified area. The soil is then loosened to a depth of 100 to 150mm. This is to prevent the fertilizer to be washed away by runoff water as well as to ensure an even spread through the treatment area. Topsoil should be mixed with the fertilizing agent (2;3;2; or manure) if needed.

RESEEDING

An appropriate seed mixture should be sown in by hand at a rate of 20kg's of seed per ha. The seeds should be lightly covered with soil by dragging a branch over the sowed area or raked with a garden rake.

An appropriate mixture of seed will depend on what is available in stock at the time. Currently the following mixture is proposed based on available stock.

Seed mixture

40% Cynodon dactylon	20% Heteropogon contortus
10% Eragrostis curvula	10% Setaria sphacelata
10% Eragrostis tef	10% Themeda triandra

AFTERCARE

When seedlings has established and reached a height of 2 to 3 cm an additional fertilizer, 50kg super phosphate per ha, can be added.

It is recommended to exclude livestock grazing and/or fire from the rehabilitated areas until the roots of the new grass plants are well established. This is to avoid the pulling out of young plants by the herbivores or physical damage due to trampling.

Of utmost importance is follow-up work on cleared areas to prevent it from re-infesting. Hand pulling of invasive species seedlings is recommended at height below 1 meter. Should follow-up herbicide spraying be needed, only broad leave herbicides should be used as not to kill the grass.

Fire should not be applied within two years from establishment. All fires applied thereafter should only take place under moist soil conditions.

Subsequent livestock trampling (and trough this, grazing pressure) can influence the longevity and so the effectiveness of the reseeded area.

6.4.2 Intervention: W42C-02-209-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Gabions and concrete road strips
Rehabilitation Objective	Protect wet area from damage by vehicles
Latitude (DºM'S")	27°15'37.90"S
Longitude (DºM'S")	30°29'21.50"E
Engineering Drawings	W42C-02-209-00
Alternatives Considered	No alternatives considered. Gabions were specified for the cut off wall as they are permeable and would allow for the movement of subsurface flows. Gabions would not be suitable for protecting the vehicle tracks as they would require on-going maintenance and concrete was therefore the preferred option for the road strips

Figure 21: Road to be stabilised/protected by means of concrete strips and a gabion cut off wall (W42C-02-209-00) looking in south-westerly direction

6.4.2.1 Bill of quantities: W42C-02-209-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete: 20 MPa	m³	4	R 6,606.37	R 26,425.46
Cement	Pockets	27.2		
Sand	m³	2.6		
Stone	m³	2.8		
3 x 1 x 1 Gabion Basket	m³	2		

Item	Units	Quantity	Unit Cost	Item Cost
Gabion Rock Volume	m³	6	R 3,000.00	R 18,000.00
Concrete: 20 MPa	m³	4	R 6,606.37	R 26,425.46
			Total	**R 44,425.46**

6.4.2.2 Construction Notes:

The gabions and road strips are to be constructed level with the natural ground. Geofabric is to be installed on all contact surfaces between the gabions and the soil.

6.4.3 Intervention W42C-02-210-00

Designer	Trevor Pike
Design Date	September 2012
Intervention Description	Erosion rehabilitation
Rehabilitation Objective	Prevent further erosion, stabilise and revegetate slope
Latitude (DºM'S")	27°15'37.90"S
Longitude (DºM'S")	30°29'21.50"E
Engineering Drawings	N/A
Alternatives Considered	N/A

Figure 22: Hillslope failure/erosion to be contoured and revegetated (W42C-02-211-00) looking in a south-westerly direction

6.4.3.1 Bill of quantities: W42C-02-210-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth Works Volume	m³	102	R 698.44	R 71,241.35
			Total	**R 71,241.35**

6.4.3.2 Construction Notes:

The bare areas (3 of) are to be rehabilitated by constructing diversion berms (to divert surface runoff off the eroding area: berms approximately 500mm high, 500mm crest width and 1 in 2 side slopes) diagonally across the bare areas at approximately 7m intervals, loosen the surface material to a depth of 100mm, apply kraal manure, grass seed and apply biojute as per suppliers specification. The emerging wattle saplings in the area are to be hand pulled.

Standard revegetation specifications:

SOIL PREPARATION

It is generally recommended that soil samples be collected and analyzed by an agricultural laboratory to determine the need for site specific supplementary fertilizing. This is especially necessary for areas cleared from Wattles.

In instances where soils sampling could not be done, soil should be prepared by applying 50kg 2:3:2 per ha or alternatively provide a good spread of "kraalmanure". Care should be taken that manure used is not contaminated with other alien invasive species.

The fertilizer must be applied by hand on the identified area. The soil is then loosened to a depth of 100 to 150mm. This is to prevent the fertilizer to be washed away by runoff water as well as to ensure an even spread through the treatment area. Topsoil should be mixed with the fertilizing agent (2;3;2; or manure) if needed.

RESEEDING

An appropriate seed mixture should be sown in by hand at a rate of 20kg's of seed per ha. The seeds should be lightly covered with soil by dragging a branch over the sowed area or raked with a garden rake.

An appropriate mixture of seed will depend on what is available in stock at the time. Currently the following mixture is proposed based on available stock.

Seed mixture

40% Cynodon dactylon

10% Eragrostis curvula

10% Eragrostis tef

20% Heteropogon contortus

10% Setaria sphacelata

10% Themeda triandra

AFTERCARE

When seedlings has established and reached a height of 2 to 3 cm an additional fertilizer, 50kg super phosphate per ha, can be added.

It is recommended to exclude livestock grazing and/or fire from the rehabilitated areas until the roots of the new grass plants are well established. This is to avoid the pulling out of young plants by the herbivores or physical damage due to trampling.

Of utmost importance is follow-up work on cleared areas to prevent it from re-infesting. Hand pulling of invasive species seedlings is recommended at height below 1 meter. Should follow-up herbicide spraying be needed, only broad leave herbicides should be used as not to kill the grass.

Fire should not be applied within two years from establishment. All fires applied thereafter should only take place under moist soil conditions.

Subsequent livestock trampling (and trough this, grazing pressure) can influence the longevity and so the effectiveness of the reseeded area.

6.4.4 Intervention W42C-02-211-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Rockpacks
Rehabilitation Objective	Stabilise the erosion gully
Latitude (DºM'S")	27°14'58.74"S
Longitude (DºM'S")	30°29'42.61"E
Engineering Drawings	W42C-02-211-00
Alternatives Considered	No alternatives considered. Gabions were preferred due to the availability of rocks on site

Figure 23: Erosion rehabilitation (intervention W42C-02-211-00) looking in a south-easterly direction

6.4.4.1 Bill of quantities: W42C-02-211-00

Item	Units	Quantity	Unit Cost	Item Cost
Rockpacks	m^3	157	R 2,000.00	R 314,000.00
Sack Gabion	m^3	22	R 3,938.67	R 86,650.74
Geotextile	m^2	460		
			Total	**R 400,650.74**

6.4.4.3 Construction Notes:

The toe of the rockpacks are to be secured with a sack gabion. Rocks are to be packed on the upstream side to the level of the top of the gully. The sack gabions, as well as the rock packs are to be keyed into the sides of the gully. A total of 6 packs are proposed for the gully ($22m^3$ of sack gabions, 157 cubic meters of rock and 460 square meters of geofabric). Volumes based on rock packs with 1m crest width, 1m height and 1 in 2 side slopes. Width of gully is 7m and depth 1m

6.4.6 Intervention W42C-02-212-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Rockpacks
Rehabilitation Objective	Stabilise the erosion gully
Latitude (DºM'S")	27°14'58.74"S
Longitude (DºM'S")	30°29'42.61"E
Engineering Drawings	W42C-02-212-00
Alternatives Considered	No alternatives considered. Rockpacks were preferred due to the availability of rocks on site making them cost effective structures. Earthen berms were not considered due to the steep gradient of the site and high energy of the runoff

Figure 24: Erosion rehabilitation (intervention W42C-02-212-00) looking in a north-westerly direction

6.4.6.1 Bill of quantities: W42C-02-212-00

Item	Units	Quantity	Unit Cost	Item Cost
Rockpacks	m³	64	R 2,000.00	R 128,000.00
Sack Gabion	m³	32	R 3,938.67	R 126,037.44
Geotextile	m²	441		
			Total	**R 254,037.44**

6.4.6.3 Construction Notes:

The toe of the rockpacks is to be secured with a sack gabion. Rocks are to be packed on the upstream side to the level of the top of the gully. The sack gabions, as well as the rock packs are to be keyed into the sides of the gully. A total of 7 packs are proposed for the gully (98m of sack gabions, 64 cubic meters of rock and 441 square meters of geofabric). Volumes based on rock packs with 1m crest width, 1m height and 1 in 2 side slopes. Gully width is 10m and depth 0.5m.

6.4.8 Intervention W42C-02-213-00

Designer	Trevor Pike
Design Date	September 2012
Intervention Description	Surface cross drains
Rehabilitation Objective	Divert flows off the road to prevent erosion of the steep areas
Latitude (DºM'S")	Linear activity. Refer to layout plans
Longitude (DºM'S")	
Engineering Drawings	W42C-02-213-00
Alternatives Considered	*In situ* cross drains are a cost effective option of managing surface runoff. Hard structures (e.g. concrete berms) were therefore not considered

Figure 25: Road to be stabilised by surface cross drain (intervention W42C-02-213-00) looking in a south-easterly direction

6.4.8.1 Bill of quantities: W42C-02-213-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth Works Volume	m³	39.2	R 698.44	R 27,379.03
			Total	**R 27,379.03**

6.4.8.2 Construction Notes:

Earthen cross drains are to be constructed at 20m intervals on the steep sections to divert surface flows off the road. The cross drains must not restrict the access of vehicles.

6.4.9 Intervention W42C-02-214-00

Designer	Trevor Pike
Design Date	September 2012
Intervention Description	Hillside erosion rehabilitation
Rehabilitation Objective	Rehabilitation of hillside erosion by means of grass seeding and water diversion berms
Latitude (DºM'S")	27°14'49.46"S
Longitude (DºM'S")	30°29'27.59"E
Engineering Drawings	N/A
Alternatives Considered	Seeding was considered the most appropriate method to rehabilitate the area. Hard options were not considered as vegetative cover was required

Figure 26: Hillside erosion rehabilitation (intervention W42C-02-215-00) looking in a north-westerly direction

6.4.9.1 Bill of quantities: W42C-02-214-00

Item	Units	Quantity	Unit Cost	Item Cost
Earth Works Volume	m^3	20	R 698.44	R 13,968.89
			Total	**R 13,968.89**

6.4.9.3 Construction Notes:

The bare area is to be rehabilitated by loosening the surface material to a depth of 100mm, apply kraal manure, grass seed and apply biojute as per supplier's specification. The area to be rehabilitated is 120 square meters. Approximately 3 diversion berms, to divert surface runoff off the eroding area, (berms approximately 500mm high, 500mm crest width and 1 in 2 side slopes) to be constructed diagonally across the bare areas. Volume of earth for 3 berms is 20 cubic meters.

6.4.11 Intervention W42C-02-215-00

Designer	Trevor Pike
Design Date	September 2012
Intervention Description	Rock packs
Rehabilitation Objective	Stabilise erosion gully next to road
Latitude (DºM'S")	27°14'49.32"S
Longitude (DºM'S")	30°29'49.31"E
Engineering Drawings	W42C-02-215-00
Alternatives Considered	Rock packs were considered cost effective interventions as they would utilise available rock on site. Earthen berms were not considered due to the steep gradient of the gully

Figure 27: Gully to be rehabilitated (W42C-02-215-00) looking in a south-easterly direction

6.4.11.1 Bill of quantities: W42C-02-215-00

Item	Units	Quantity	Unit Cost	Item Cost
Rockpacks	m^3	289	R 2,000.00	R 578,000.00
Sack Gabion	m^3	37	R 3,938.67	R 145,730.79
Geotextile	m^2	730		
			Total	**R 723,730.79**

6.4.11.3 Construction Notes:

The toe of the rockpacks is to be secured with a sack gabion. Rocks are to be packed on the upstream side to the level of the top of the gully. The sack gabions, as well as the rock packs are to be keyed into the sides of the gully. A total of 10 packs are proposed for the gully, 112m of sack gabions, 289 cubic meters of rock and 730 square meters of geofabric). Volumes based on rock packs with 1m crest width, 1m height and 1 in 2 side slopes. Gully width varies from 10m to 6m and depth is 1m.

6.4.13 Intervention W42C-02-216-00

Designer	Trevor Pike
Design Date	September 2012
Intervention Description	Gabions and earthen berms and rockfill of the flow path
Rehabilitation Objective	Deactivate erosion gully
Latitude (DºM'S")	27°15'2.92"S
Longitude (DºM'S")	30°30'29.85"E
Engineering Drawings	W42C-02-216-00
Alternatives Considered	Gabions were considered cost effective interventions on the steep areas as they would utilise available rock on site. Earthen berms were specified on the flatter areas. Concrete was not considered due to the associated costs

Figure 28: Deactivation of erosion gully next to road (W42C-02-216-00) looking south-southeast

6.4.13.1 Bill of quantities: W42C-02-216-00

Item	Units	Quantity	Unit Cost	Item Cost
2 x 1 x 1 Gabion Basket	Baskets	1		
3 x 1 x 1 Gabion Basket	Baskets	6		
4 x 1 x 1 Gabion Basket	Baskets	3		
Earth Works Volume	m^3	70		
Gabion Rock Volume	m^3	32	R 3,000.00	R 96,000.00
Sack Gabion	m^3	13	R 3,938.67	R 51,202.71
Rockpacks	m^3	89	R 2,000.00	R 178,000.00

Item	Units	Quantity	Unit Cost	Item Cost
Geotextile	m^2	286		
			Total	**R 325,202.71**

6.4.13.2 Construction Notes:

The toes of the rockpacks are to be secured with a sack gabion. Rocks are to be packed on the upstream side to the level of the top of the gully. The sack gabions, as well as the rock packs are to be keyed into the sides of the gully. The gabion walls are to be constructed across the gully to stabilise the gully and trap sediment. Volume of gabions is 32 cubic meters, rock packs are 66 cubic meters, sack gabions are 40m and geotextile is 286 square meters. The flow channel between the gabions is to be filled with rocks (23 cubic meters).

6.4.15 Intervention W42C-02-217-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Gabions and earthen berms
Rehabilitation Objective	Deactivate old road and protect new road with surface cross drains
Latitude (DºM'S")	Linear feature
Longitude (DºM'S")	Linear feature
Engineering Drawings	W42C-02-217-00
Alternatives Considered	Deactivation of old road: Gabions were considered cost effective interventions on the steep areas as they would utilise available rock on site. Earthen berms were specified on the flatter areas. Protection of new road: *In situ* cross drains are a cost effective option of managing surface runoff. Hard structures (e.g. concrete berms) were therefore not considered

Figure 29: Deactivation of old road (left hand side photo) and protection of new road (right hand side photo) by means of gabion walls and earthen diversion berms (W42C-02-217-00)

6.4.15.1 Bill of quantities: W42C-02-217-00

Item	Units	Quantity	Unit Cost	Item Cost
2 x 0.5 x 0.5 Gabion Basket	Baskets	3		
Gabion Rock Volume	m^3	1.5	R 3,000.00	R 4,500.00

Item	Units	Quantity	Unit Cost	Item Cost
Earth Structure Volume	m^3	113	R 793.01	R 89,609.81
Earth Works Volume	m^3	44.1	R 698.44	R 30,801.41
2 x 0.5 x 0.5 Gabion Basket	Baskets	3		
			Total	**R 124,911.22**

6.4.15.2 Construction Notes:

The length of the old road to be closed is 280m. A total of 5 gabion diversion walls (5x0.5x0.5) and 10 earthen berms (total of 130 cubic meters) are to be constructed on the old road. Approximately 18 surface cross drains are required on the new road

6.4.16 Intervention W42C-02-218-00

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Concrete road strips, backfilling of trench and fencing
Rehabilitation Objective	Protect seep and wetland area from damage by vehicles, promote diffuse flows cattle trampling
Latitude (DºM'S")	27°15'43.92"S
Longitude (DºM'S")	30°30'50.46"E
Engineering Drawings	W42C-02-218-00
Alternatives Considered	Concrete was considered a permanent and suitable material for the road strips. Gabions were not considered due to the associated maintenance requirements

Figure 30: Section of road requiring concrete strips and adjacent trench (right side of road) to be backfilled (W42C-02-218-00), looking in a south-south-eastern direction

6.4.16.2 Bill of quantities: W42C-02-218-00

Item	Units	Quantity	Unit Cost	Item Cost
Concrete: 20 MPa	m^3	9	R 6,606.37	R 59,457.29
Cement	Pockets	61.2		
Sand	m^3	5.85		
Stone	m^3	6.3		
Earth Works Volume	m^3	10	R 698.44	R 6,984.45
			Total	**R 66,441.73**

6.4.16.3 Construction Notes:

Concrete road strips, backfilling of the trench adjacent to the road and fencing: The concrete strips will reduce the disturbance to the road in the wet area, whilst backfilling the trench will reduce the diversion of water away from the wetland. The seepage area is to be fenced off to prevent damage by livestock. The length of the concrete strips is 60m, length of fencing is 310m and backfill in trench is 10 cubic meters (40m long)

6.4.17 Intervention W42C-02-219-00

Designer	Trevor Pike
Design Date	September 2012
Intervention Description	Concrete Weir and stock watering trough
Rehabilitation Objective	Deactivate headcut erosion and protect seep area from damage by cattle
Latitude (DºM'S")	27°15'43.92"S
Longitude (DºM'S")	30°30'50.46"E
Engineering Drawings	W42C-02-219-00
Alternatives Considered	An impermeable structure was required and gabions were therefore not considered for stabilising the headcut

Figure 31: Headcut erosion stabilisation with concrete (intervention W42C-02-219-00) looking in a north-westerly direction

6.4.17.1 Bill of quantities: W42C-02-219-00

Item	Units	Quantity	Unit Cost	Item Cost	Estimated Labour Budget %	Labour budget
Gabion Rock Volume	m^3	4.8	R 3,000.00	R 14,400.00		
Concrete: 20 MPa	m^3	38.68	R 6,606.37	R 255,534.21		
Cement	Pockets	263.024				
Sand	m^3	25.142				
Stone	m^3	27.076				
Weldmesh Ref 617	m^2	60.93				

Item	Units	Quantity	Unit Cost	Item Cost	Estimated Labour Budget %	Labour budget
Weldmesh Ref 888	m^2	113.74				
Mass of Steel	kg	529				
Total				**R 269,934.21**		

6.4.17.2 Construction Notes:

The spillway of the weir is to be built to the level of the top of the headcut. Weepholes are to be installed through the spillway (350mm above the level of the slab), and a subsoil drain is to be installed at the base on the back/behind the spillway. A counter weir (300mm high) is to be constructed to allow for the collection of water. A pipe is to be installed into the counter weir (and then buried) to carry water to a suitable area where it is to be connected to a stock watering trough with a ball valve to control flows. The area around the trough is to be protected with a concrete capped Reno mattress.

6.4.19 Intervention W42C-02-220-00 to W42C-02-225-00

Designer	Trevor Pike
Design Date	September 2012
Intervention Description	Surface cross drains
Rehabilitation Objective	Divert flows off the road to prevent erosion of the steep areas
Latitude (DºM'S")	Linear activity. Refer to layout plans
Longitude (DºM'S")	
Engineering Drawings	W42C-02-221-00- W42C-02-226-00
Alternatives Considered	*In situ* cross drains are a cost effective option of managing surface runoff. Hard structures (e.g. concrete berms) were therefore not considered

Figure 32: Surface cross drain (interventions W42C-02-221-00 to W42C-02-226-00) looking in a south and south-easterly direction

6.4.19.2 Bill of quantities: W42C-02-220-00 to W42C-02-225-00

Intervention No.	Item	Units	Quantity	Unit Cost	Item Cost
W42C-02-220-00	Earth Works Volume	m³	51.45	R 698.44	R 35,934.97
W42C-02-221-00	Earth Works Volume	m³	22.05	R 698.44	R 15,400.70
W42C-02-222-00	Earth Works Volume	m³	12.25	R 698.44	R 8,555.95
W42C-02-223-00	Earth Works Volume	m³	9.8	R 698.44	R 6,844.76
W42C-02-224-00	Earth Works Volume	m³	7.35	R 698.44	R 5,133.57
W42C-02-225-00	Earth Works Volume	m³	34.3	R 698.44	R 23,956.65
				Total	**R 95 826.60**

6.4.19.3 Construction Notes:

Earthen cross drains are to be constructed at 20m intervals on the steep sections to divert surface flows off the road. The cross drains must not restrict the access of vehicles.

6.4.21 Intervention W42C-02-226-00 and W42C-02-227-00

Designer	Trevor Pike
Design Date	September 2012
Intervention Description	Surface cross drains
Rehabilitation Objective	Divert flows off the road to prevent erosion of the steep areas
Latitude (DºM'S")	Linear activity. Refer to layout plans
Longitude (DºM'S")	
Engineering Drawings	W42C-02-226-00 & W42C-02-227-00
Alternatives Considered	*In situ* cross drains are a cost effective option of managing surface runoff. Hard structures (e.g. concrete berms) were therefore not considered

Figure 33: Surface cross drain (interventions W42C-02-227-00 and W42C-02-228-00) looking in a south and south-easterly direction

6.4.21.1 Bill of quantities: W42C-02-226-00 & W42C-02-227-00

Intervention No.	Item	Units	Quantity	Unit Cost	Item Cost
W42C-02-226-00	Earth Works Volume	m³	78.4	R 698.44	R 54,758.06
W42C-02-227-00	Earth Works Volume	m³	58.8	R 698.44	R 41,068.54
Total					**R 95 826.60**

6.4.21.2 Construction Notes:

Earthen cross drains are to be constructed at 20m intervals on the steep sections to divert surface flows off the road. The cross drains must not restrict the access of vehicles.

6.5 Construction Environmental Management Plan Issues

The proposed rehabilitation is to be undertaken on privately owned land and the project team should access the site and manage the site in accordance with the WfWet best management practices and specific requirements of the land owner. The implementation of these interventions must also take into account all relevant provisions of Working for Wetlands Best Management Practices and the Construction Environmental Management Plan, the recommendations of the Basic Assessments submitted for Environmental Authorisation and the requirements of the Environmental Authorisation Record of Decision for the project.

The general construction notes, the Construction phase EMP (CEMP) are included as Appendix B and F.

The following project-specific management issues apply:

- The area generally provides habitat for a number of Red Data species and the construction activities should be planned and managed to reduce impacts on the fauna and flora in the area in accordance with WfWet best management practices and with input from the land owner and local conservation organisations.

6.6 Wetland Management Recommendations

The system is currently utilised for livestock grazing, but following the implementation of the rehabilitation activities certain areas of the system will become inaccessible for livestock due to fencing (seepage areas). The landowner should consider managing livestock access to limit grazing in these sensitive areas.

6.7 Baseline M&E Data

The collection of baseline information was carried out to show changes in the system associated with the wetland rehabilitation activities.

6.7.1.1 Erosion Problems

The erosional features within the wetland are generally planned to be stabilised at the head of the erosional feature, and will therefore not be monitored. If these features were to be stabilised by back-flooding from a downstream intervention, monitoring would have been necessary.

6.7.1.2 Fixed Point Photography

In order to provide the ability to visually determine the degree of change within the wetland system photography of the wetland system has been taken prior to the implementation of wetland rehabilitation activities.

Locations

FPP Number	01	
GPS Location (DMS)	Latitude	27 15’ 43.39” S
	Longitude	30 30’ 49.56” E
Description of Photography Point		
The photograph was taken from an elevated area looking downhill in a south-easterly direction.		

Photographs

Figure 34: View of the Paardeplaats seep/wetland looking in a southerly direction

6.7.1.3 Baseline WET-Health Data

The assessment of the current level of ecological integrity of the wetland system provides a baseline assessment for comparative assessments that would be carried out for monitoring purposes 3 years after completion of the wetland rehabilitation activities. The following WET-Health information was collected for the wetland (Refer to APPENDIX A):

HGM Unit	Area (ha)	Hydro Health	Geo Health	Vegetation Health
W42C-02	0.61	7	9.1	8.1

7. Wakkerstroom Wetland: Maintenance: WC-42-03-201-01

During a site visit to the Wakkerstroom Wetland, it was discovered that one of the interventions did not function properly, and could be improved. A ditch was dug in the wetland in order to achieve diffuse flow onto an area southwest of a straightened drainage channel. The ditch is however too shallow to ensure flow throughout the year.

It is therefore proposed that the material is excavated from the ditch in order to ensure a deeper channel and thus flow in the channel throughout the year and not only during the peak rainfall months.

7.1 Intervention V31A-01-201-01

Designer	Trevor Pike
Design Date	July 2012
Intervention Description	Earthworks/Excavation
Rehabilitation Objective	Deepen channel to achieve diffuse flow throughout the year
Latitude (DºM'S")	27°20'50.10"S
Longitude (DºM'S")	30° 8'57.59"E
Engineering Drawings	V31A-01-201-01
Alternatives Considered	N/A

Figure 35: Channel to be excavated (V31A-01-201-01), looking in a north-easterly direction

7.1.1.2 Bill of quantities: V31A-01-201-01

Item	Units	Quantity	Unit Cost	Item Cost
Earth Works Volume	m^3	97.5	R 698.44	R 68,098.35
			Total	**R 68,098.35**

7.1.1.3 Construction Notes:

The channel is to be lowered by 300mm over a distance of 65m and is to be shaped to a trapezoidal shape.

APPENDIX A – WETLAND ASSESSMENT REPORTS

ASSESSMENT OF WETLAND HABITAT TO INFORM WORKING FOR WETLAND'S PHASE 2 REHABILITATION PLANNING PROCESS.

DRAFT FOR REVIEW

Province: Mpumalanga
Project: Wakkerstroom
Wetland Practitioner: Bradley Graves
Wetland Name: W42C-02
Assessment Date: 1 October 2012

1. Introduction

Specialist input was required as a component of the rehabilitation planning process undertaken by Aurecon South Africa (Pty) Ltd on behalf of the South African National Biodiversity Institute's (SANBI) Working for Wetland's (WfWet) Programme. GroundTruth was appointed to undertake the required assessments of the present ecological state and the ecosystem services supplied, for those wetland systems in the Mpumalanga province projects. These assessments assist in providing a baseline assessment that serves to inform planning and monitoring of the system by:

- identifying the current impacts and threats to the wetland system;
- predicting the levels of loss linked to the continued degradation of the system if interventions are not implemented;
- predicting the contribution of the proposed rehabilitation strategy in terms of improving the wetland functioning and health; and
- evaluating the cost-effectiveness or 'return on investment' of the proposed rehabilitation against the improvement of the identified wetland's functioning and health.

The approach and results from the assessment of the **W42C-02** wetland system within the **Wakkerstroom Project** are outlined in this report.

2. Background Information

The Wakkerstroom wetland rehabilitation project comprises of two current project sites, namely Goedgevonden farm and Paardeplaats Nature Reserve (PNR). Both project sites are located in the W42C quaternary catchment, near the towns of Wakkerstroom and Luneburg. The rehabilitation planning focuses on those portions of the W42C quaternary catchment within Mpumalanga province. The 2012 planning season for this project is a continuation of existing work already identified and implemented within this catchment.

Wetland W42C-01, on the Goedgevonden farm, was generally considered to be the most appropriate candidate for rehabilitation based on the size of the HGM unit, its biodiversity value in terms of peatland habitat and Wattled Crane nesting site, and its position in the landscape. However due to the requirement for labour intensive rehabilitation interventions, additional wetlands needed to be assessed, with PNR being identified as an appropriate candidate for labour-intensive rehabilitation, and terrestrial land management of benefit to freshwater ecosystems. Earthworks and earth structures primarily, would be required to address the identified impacts and effectively enhance management of the reserve.

A review of the Mpumalanga Biodiversity Conservation Plan (MBCP) highlights that seepage wetland W42C-02 falls within a zone that is considered to be ‘critically endangered’ and ‘moderately protected’ in terms of its contribution towards aquatic biodiversity. The rehabilitation of the wetland systems within this area is therefore likely to contribute towards the maintenance of the biodiversity within the region. The W42C catchment is characterised by 1016mm of annual precipitation and in excess of 1813mm of evapotranspiration. This suggests that the wetlands within the catchment are likely to be moderately susceptible to alterations of water inputs in the wetlands' catchments.

3. Methodology

The following methodology was adopted for the study and comprised of multiple steps, which relies on the information generated during previous components of the rehabilitation planning.

3.1 Mapping of the Wetland Boundary and Features

It is necessary at the outset to have an approximation of the size of the wetland to be rehabilitated. In this case the wetland mapping was undertaken at a desktop level using available aerial imagery and contour data. During the site visit, infield sample points were collected using a Trimble Geo XT Global Positioning System (GPS) to inform the production of a spatial coverage of the impacts on the wetland and features within the system. This information was then used in the rehabilitation planning process to calculate impacted areas and those potentially affected by the rehabilitation activities.

3.2 Assessments of Current and Post-Rehabilitation Scenarios

The assessment of the wetland system for the WfWet rehabilitation planning process was based on the 'Rapid WET-Tools' assessment technique, developed and refined in conjunction with the authors of:

- WET-EcoServices (Kotze *et al*, 2007); and
- WET-Health (Macfarlane *et al*, 2007)

This modified approach for assessing the functioning and integrity of the system comprises of the following steps:

- Description of the hydrogeomorphic setting of the wetland;
- Description of the specific benefits and services that will be improved by the proposed rehabilitation;
- Description of the overall health of the wetland at a Level 1 using WET-Health; and
- Identification of specific impacts and/or threats to be addressed by rehabilitation and description of these at a Level 2 using WET-Health, such as, the impacts on the system associated with drainage canals.

In accordance with requirements of the Department of Water Affairs, an assessment of the wetlands' importance and sensitivity was undertaken using the assessment framework developed by Rountree & Malan (2010).

These assessment techniques serve to:

- illustrate the anticipated improvement in the provision of wetland goods and services under the hypothetical rehabilitated conditions brought about by the implementation of the rehabilitation plan;
- provide a description of the systems' importance and sensitivity under the current land-use scenario; and
- provide a description of the systems' ecological integrity under the current land-use scenario and establish a baseline with which the wetland hectare-equivalents gained by the rehabilitation of the system could be compared to those that would be lost with the continued degradation of the system.

The results of these assessments were used to inform the subsequent rehabilitation planning process, set the rehabilitation objectives and choose the appropriate measures to achieve these objectives.

4. Assumptions and Limitations

Studies that focus on the interpretation of future scenarios rely on various assumptions, with the following assumptions being made during the assessment of this particular wetland system:

- The reference/benchmark vegetation of the wetland was considered to be sedge meadow, based on the vegetation composition of the adjacent intact portions of wetland.
- The recovery of the wetland vegetation within the system under anticipated rehabilitated conditions was expected to follow a pattern of succession with ruderal pioneer species first colonising the site and being replaced over a period of time by a more perennial, stable plant community. For this reason a lag period of three years was adopted to illustrate the medium-term impacts on vegetation following the hypothetical rehabilitation of the site.
- An alien plant control programme would be implemented and maintained within the wetlands and their catchments; and
- The importance of the wetland within the landscape would be enhanced by improved management adopted by the landowner or manager.

Limitations and uncertainties often exist within the approaches and techniques used to assess the condition of natural systems, with the following limitations applying to the studies undertaken for this report:

- The extent of the hydrogeomorphic unit was derived from aerial imagery, with limited infield verification, and the accuracy of the derived information is limited.
- The actual response of the system to the proposed rehabilitation may vary from the anticipated conditions due to the dynamic nature of wetland ecosystems within the landscape;
- The assessment techniques used in this study were limited by time and budgetary constraints applicable to the type and level of survey undertaken. Generally, the studies undertaken would be classified as rapid studies with moderate confidence values recorded for the various criteria assessed. GroundTruth therefore reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.

5. Results

The hydrogeomorphic setting of the wetland unit is a hillslope seep feeding a water course fed by water inputs from hillslope processes and sub-surface water (**Figure 5-1**). The system is approximately 0.61ha in extent and has an estimated length of 130m. The wetland occurs within a conservation area that was historically used for agricultural production and the wetland's catchment is characterized by natural veld, but there are areas of alien invasive vegetation and cultivated fields. The system has been subjected to a number of impacts associated with modifications of the system's hydrology, including drainage canals.

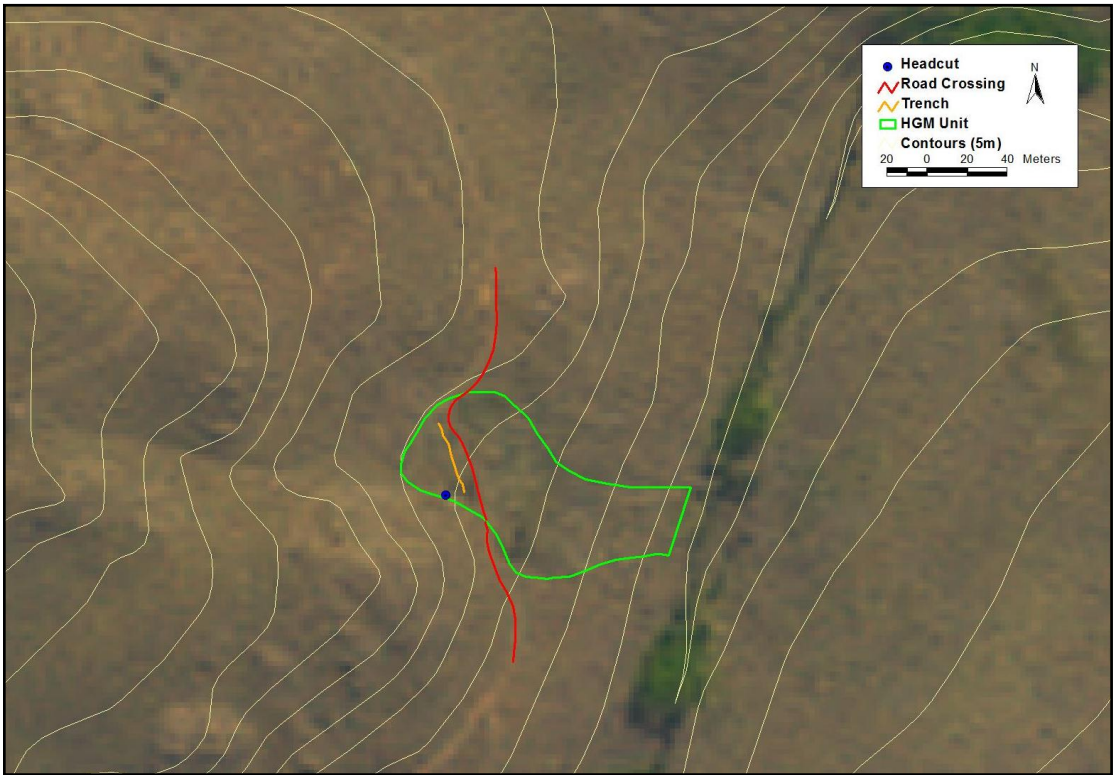


Figure 5-1. View of the W42C-02 wetland

5.1 Wetland Importance and Sensitivity

The assessment of the wetland's importance and sensitivity (**Table 5-1**) suggests that the wetland is contributing towards supporting biodiversity, which is linked to the presence of Wattled Crane in the vicinity. The nature of the system, in terms of being supplied by sub-surface flow, reduces the system's sensitivity to alterations and the likelihood of high levels of services linked to water quantity and quality, with the exception of stream flow regulation, as it is connected to the stream network. The system does provide a level of direct benefits, primarily linked to water and grazing resources.

Table 5-1. Importance and sensitivity of the wetland

	Importance*
Ecological importance & sensitivity	2.0
Hydro-functional importance	1.1
Direct human benefits	0.8

*measured on a scale of None (0) to Very High (4).

In terms of assessing the potential improved benefits and services as a result of the planned rehabilitation, it is anticipated that the rehabilitation of the system is likely to result in improved levels of ecosystem delivery for water quantity and biodiversity within the landscape. It is evident from the current use of the system that the wetland would be important in terms of the direct utilisation of grazing resources within the wetland.

Table 5-2. Anticipated improvement in ecosystem services due to the rehabilitation activities

	Score	**Comments**
Flood attenuation	*No Effect Anticipated*	Slope of the system limits its effectiveness in terms of flood attenuation, which will be unaffected by the rehabilitation activities.
Stream flow regulation	*Slight Positive Effect Anticipated*	The deactivation of the trench will promote an increase in the retention time of water in the system extending the period of time that base flows enter the downstream valley bottom system
Sediment trapping	*No Effect Anticipated*	The lack of identifiable sources of sediments limits the system opportunity to provide this benefit within the landscape.
Phosphate trapping	*No Effect Anticipated*	The lack of identifiable sources of nutrients and toxicants limits the system opportunity to provide this benefit within the landscape.
Nitrate removal	*No Effect Anticipated*	The lack of identifiable sources of nutrients and toxicants limits the system opportunity to provide this benefit within the landscape.
Toxicant removal	*No Effect Anticipated*	The lack of significant sources of toxicants limits the system opportunity to provide this benefit within the landscape.
Erosion control	*Positive Effect Anticipated*	The trench and headcut and the road crossing pose a risk to the erosion control within the system. Interventions addressing these problems are likely to improve erosion control.
Carbon storage	*Slight Positive Effect Anticipated*	The protection of portions of the wetland, especially the seasonal wetness zones, is anticipated to provide more effective carbon storage in these areas. .
Maintenance of biodiversity	*Slight Positive Effect Anticipated*	The protection of portions of the wetland, especially the various wetness zones, is anticipated to provide more habitat variability in the area for wetland dependant species
Water supply for human use	*No Effect Anticipated*	The water in the system will not be utilised directly by humans.

Table 5-2 (cont.) Anticipated improvement in ecosystem services due to the rehabilitation activities

	Score	Comments
Natural resources	*Slight Negative Effect Anticipated*	The wetland will be protected from cattle, limiting the damage done to the system, but reducing the provision of grazing resources
Cultivated foods	*No Effect Anticipated*	The system is not used for crop production and is unlikely to be improved by the proposed rehabilitation.
Cultural significance	*No Effect Anticipated*	There was no evidence that the system is used for by local community for cultural practices.
Tourism and recreation	*No Effect Anticipated*	The system may provide this ecosystem service within the landscape in future, being a reserve, but is unlikely to be improved by the proposed rehabilitation.
Education and research	*No Effect Anticipated*	The system is unlikely to provide this ecosystem service within the landscape

5.2 Wetland Health Assessment

When considering the wetland system's integrity it is important to consider the levels of integrity of each of the ecological components:

- Hydrology;
- Geomorphology; and
- Vegetation.

The integrity of the ecological and biophysical drivers of the wetland was assessed for the current scenario.

Table 5-3. Summary of the present health of the wetland based on the impact score

Wetland No	Ha	Extent (%)	Hydrology		Geomorphology		Vegetation	
			Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
W42C-02	0.61	100	3.0	-1	0.9	-1	1.9	0
PES Categories			**C**	→	**A**	→	**B**	→
Wetland Impact Score			**2.09**					
Wetland PES*			**C**					

*Present Ecological State categories used to define health of wetlands (MacFarlane *et al*, 2007)

Description	Impact score	Present State Category
Unmodified, natural.	0 – 0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1 – 1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 – 3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4 – 5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10	F

5.2.1 Hydrology

The hydrological integrity of the wetland is moderately modified, with impacts recorded as a result of the trench and road in the upper reaches of the system. This has resulted in the alteration of flow characteristics over a portion of the wetland, also resulting in changes in surface roughness. Generally, the system is fed by sub-surface flow and is therefore relatively robust in terms of the impacts of the road and trench.

5.2.2 Geomorphology

The geomorphology of the wetland is considered to be largely unmodified, which is attributed to the fact that the position of the headcut within the system is such that it does not affect a large percentage of the area of the seep. The prevalence of rock near the soil surface and across portions of the wetland, suggests that the system is well protected against erosion with geological control points throughout its length.

5.2.3 Vegetation

The changes to the system's hydrology has resulted in areas of the wetland becoming desiccated and dominated by terrestrial plant species, while other areas have become dominated by species favouring disturbance. The transformation of the vegetation is limited to the upper portions of the wetland where the most historical disturbance has taken place.

5.3 Wetland Rehabilitation

The following section serves to describe the rehabilitation of the wetland, including the problems to be addressed and the objectives, which attempt to maximise the increase in the levels of system functioning and integrity.

5.3.1 Wetland Problems

The biophysical drivers of the wetland have been impacted upon by historical activities, including *inter alia*:

- construction of an access road through the wetland;
- the diversion of flow by a trench adjacent to the road; and
- partial flooding or impoundment of flow by the existing road.

The upper portion of the wetland has been subjected to a number of impacts associated with the modification of the system's hydrology, which was likely to have been initiated to allow access across the wetland (Figure 5-2). The problems identified within the wetland system can be addressed with the implementation of rehabilitation activities, which would include the deactivation of the headcut and trench, and the installation of concrete road strips.

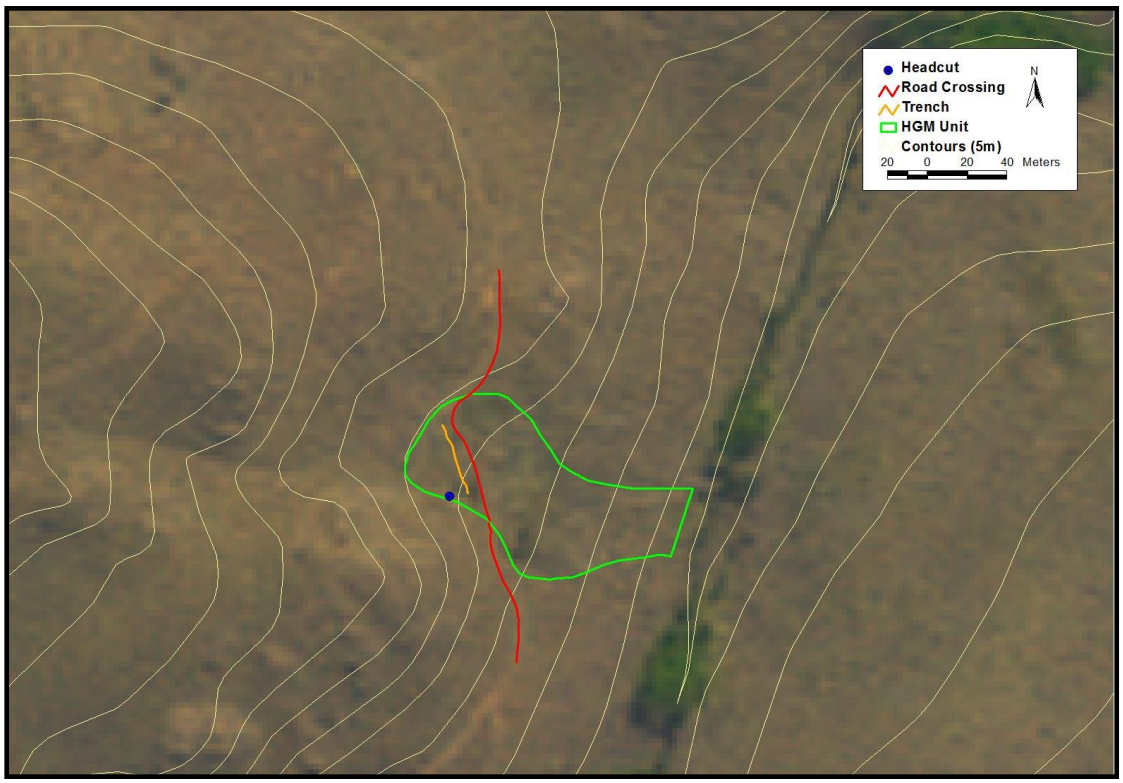


Figure 5-2. View of the problems identified within the HGM unit

5.3.2 Wetland Rehabilitation Objectives

With the implementation of wetland rehabilitation it is important to set aims and objectives for the planned rehabilitation in accordance with WET-RehabPlan (Kotze *et al*, 2009). Based on the assessment of the ecological services supplied by the system, the level of service delivery and system integrity is likely to improve with the promotion of diffuse flow within the wetland.

Objective:
The primary objectives of the rehabilitation are as follows:

- reduce the threat to the seep/wetland area by headcut erosion;
- promote diffuse flow;
- reduce further impacts from the road; and
- protect the wetland from cattle using it as a water point.

5.3.3 Wetland Rehabilitation Strategy

Based on the observation that the functioning and integrity of the wetland system would improve by deactivating the diversions of flow through the system and promoting diffuse flow, the rehabilitation activities would adopt the following approaches.
Interventions:

- to reduce the threat to the seep/wetland area by stabilising the headcut erosion;
- to promote diffuse flow by deactivating a drainage ditch adjacent to the road;
- to reduce further impacts from the road using formalised concrete road strips; and
- to protect the wetland by fencing off the area from cattle using it as a water point.

5.3.4 Effect and Cost-effectiveness of the Proposed Rehabilitation Strategy

The assessment of the wetland for both the current and rehabilitated scenarios highlighted that with the implementation of the rehabilitation strategy it is anticipated that the ecological integrity of the system would improve from a '**C**' to an '**A**' ecological category (**Table 5-2**).

Table 5-4. Ecological Integrity of the wetland system for the assessed scenarios

		Status Quo	With Rehabilitation
Size of wetland (Ha)		0.61	0.61
Impact Scores	**Hydrology**	3.0	1.0
	Geomorphology	0.9	0.5
	Vegetation	1.9	1.7
	Overall Composite Score (3:2:2 Ratio)	2.09	1.06
Ecological Category		**C**	**B**

This improvement in ecological integrity translates into a gain of **0.07 hectare equivalents** within the landscape (**Table 5-5**). With the estimated cost of the rehabilitation within the wetland being **R 721 653** the cost-effectiveness is considered to be '**Low**'. However, the rehabilitation does fall within a nature reserve that is considered to be 'critically endangered' in terms of biodiversity according to the MBCP, and the interventions are geared towards assisting with the improved management of the reserve as a whole by providing stable access that has minimal impacts on sensitive areas, such as wetlands. The rehabilitation

would also serve to improve the nature of flows into the main valley-bottom wetland, which is not taken into consideration in this assessment.

Table 5-5. Evaluation of the expected cost-effectiveness of the rehabilitation strategy

Estimated Cost of planned interventions	R 721 653
Hectare/Functional Equivalents of Wetland Habitat	
Future scenario with no intervention/s	0.48
Future scenario with intervention/s	0.55
Hectare/Functional Equivalents Gained	0.07
Cost per Hectare/Functional Equivalent	R 7 216 530
Cost-effectiveness*	**Low**
Anticipated Maintenance Requirements	**Low**

*Cost-effectiveness of rehabilitation (Kotze *et al*, 2009)

Cost of rehab interventions per hectare of re-instated/ secured intact wetland	**Likely cost effectiveness**
< R50 000 per ha	The cost effectiveness of the project is likely to be high.
R50 000 - R150 000 per ha	The cost effectiveness of the project is likely to be intermediate to high.
R150 001 - 300 000 per ha	The cost effectiveness of the project is likely to be moderate but can be justified if returns in terms of ecosystem system delivery are moderate to high.
R300 001 - 500 000 per ha	The cost effectiveness of the project is likely to be low to intermediate, but can be justified if benefits are high. Therefore, benefits would need to be well justified.
>R500 000 per ha	The cost effectiveness of the project is likely to be low. Such a project would need to be extremely well motivated such that it could only be justified if benefits are exceptionally high.

6. References

KOTZE DC, ELLERY WN, ROUNTREE M, GRENFELL MC, MARNEWECK G, NXELE IZ, BREEN DC, DINI J, BATCHELOR AL, AND SIEBEN E, 2009. WET-RehabPlan: Guidelines for planning wetland rehabilitation in South Africa. WRC Report No. TT 336/09. Water Research Commission, Pretoria.

KOTZE DC, MARNEWECK GC, BATCHELOR AL, LINDLEY DS & COLLINS NB, 2007. WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands. WRC Report No TT 339/08, Water Research Commission, Pretoria.

MACFARLANE, D.M; KOTZE, D; WALTERS, D; KOOPMAN, V; GOODMAN, P; ELLERY, W; GOGE, C. 2007. WET-Health. A technique for assessing wetland health. WRC Report No. TT340/08, Water Research Commission, Pretoria.

ROUNTREE, M.W. AND H. MALAN (Editors). 2010. Rapid Ecological Reserve Determination Methods for Wetlands (Version 2.0). Joint Department of Water Affairs and Water Research Commission Study. In preparation. Water Research Commission, Pretoria.

APPENDIX B - GENERAL CONSTRUCTION NOTES

(Ignore notes which are not applicable)

1. **Occupational health and safety is a priority!** All necessary precautionary Measures must be undertaken to ensure safety of the team. Particular attention must be given to deep excavations where gentle sloping back of soil or shoring must be applied to prevent possible soil collapse. Where risks are foreseen, these must be reported to the Occupational Health and Safety Agent employed by SANBI, who may need to seek further advice. In addition, no excavated earth or other materials should be stockpiled within a distance of one metre from the edge of any excavation. The one metre wide strip along the edges of all sides of an excavation should at all times be kept clear of objects such as lumps of clay, rocks or tools that could injure workers in the excavation if they were to fall in.

2. Check all dimensions on site to determine if any amendments to the designs are necessary. Note the required final height of the structure relative to the original ground level. The responsible engineer must be consulted before any changes are made to dimensions.

3. Excavation must be carried out to the final levels. Soil must be placed in areas best suited for re-use, for example, when building an earthen diversion embankment, the soil excavated should be used immediately in building up the embankment (on condition the excavated soil is of suitable quality). The excavated soil should alternatively be stockpiled immediately upstream of the site of the proposed wall. The topsoil must be stockpiled separately from the subsoil.

4. Where soil is to be the foundation for non-soil structures (for example, gabions and rafted weirs), all sand deposits must be removed and the floor well compacted while the soil is at optimum moisture content.

5. In instances where the addition of lime has been specified for the amelioration of a dispersive soil, mixing must be carried out off site, after which it must be transported to the construction site.

6. When the final level of the soil construction has been reached the previously stockpiled topsoil must be added as an extra height and planted to suitable vegetation (unless other provision for protection of the structure has been specified).

7. When backfilling soil against concrete or gabion work, extra care must be taken to ensure that a waterproof join with the structure is, as far as possible, achieved. Compaction must be carried out in layers as specified by the engineer. Material containing organic matter must not be used for this backfilling purpose.

8. Ensure that the correct steel reinforcing, as specified, has been delivered to site. Ensure that the minimum cover, as specified by the engineer, is achieved at all times. All welded steel mesh joins must have an overlap of at least 200mm and must be securely tied with 2mm building wire. At least three rings at 150mm spacing are required. Where reinforcing

bars are used, bars at joins must be overlapped as per the distance specified on the drawings. Particular attention must be paid to ensure the correct placing of steel reinforcing (particularly steel mesh with different bar sizes).

9. Before placing concrete on a rock foundation, carefully chip away any loose surface layers and wash away all debris. New surfaces must be painted with a cement slurry prior to the placing of the concrete.

10. Ensure that all shuttering is strong and well supported. It is recommended that the concrete be placed in layers no greater than one metre per day. The shuttering must be well oiled on the inside to prevent the concrete from sticking. Spacers between shuttering must be placed every one metre, both vertically and horizontally, with a minimum of two in both directions.

11. Note that when mixing concrete it is preferable to use a full pocket of cement with each mix. The specified cement water ratio must be maintained at all times.

12. The poured concrete must be "rodded" to ensure proper compaction. Never add more than one metre height of concrete in any one day, and attempt to lay the concrete in even, horizontal layers throughout the length of any section. Check the specifications for any requirement of expansion joints. The shuttering should be left for at least two days before stripping. Wetting the concrete while it is curing will make for a strong construction. Backfilling of soil against the completed structure may only be done after a period of at least seven days.

13. The use of "plums" in concrete: in some instances it may be feasible and economic to reduce the amount of concrete in mass gravity structures, by replacing up to 33% of the volume of concrete by the judicious use of suitable hand sized quarried rock. Where this is specified the rocks (purchased as handstone) must be so placed that there is always a minimum cover of 50mm between the rock and the shuttering, as well as between any two adjacent rocks. This should only be done where it is stated on the drawings that is permissible.

14. The standard procedures for the opening up and wiring together of gabion baskets and mattresses are well documented, and supplied with every delivery of the products. They must be strictly adhered to in all respects. Ensure that the lids of the final (top) baskets are always folded down and wired in a downstream direction.

15. Where rock-filled gabion baskets are used for the construction of keywalls, the trenches must be dug wide enough so that sufficient access is available to properly backfill and compact all the way around them. Making the trench only wide enough to receive the baskets is not acceptable, as water will eventually find its way around the structures and cause problems.

16. Where structures are to be built in dispersive soils, the following should be noted:

    - Impermeable cut off wall (at least 500mm deep) to be constructed under spillway section of the structure

- Key walls to be impermeable
- Impermeable barriers to be constructed between key walls and spillway section of structures

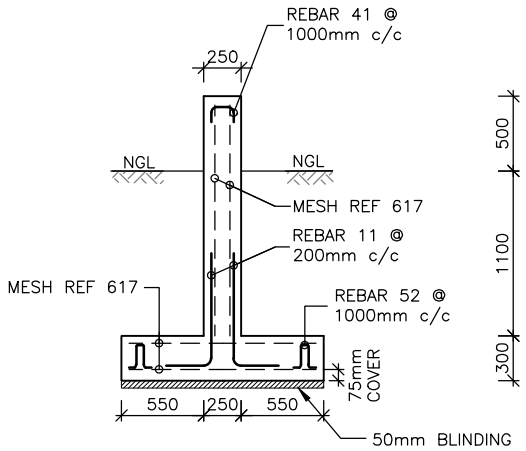
17. Sloping and vegetating gully banks where specified:

    Where the gully is no more than approximately 1.0 metre deep, and the catchment area small (say ten hectares), the topsoil of the site immediately adjoining the channel is removed and stockpiled in a safe place nearby. The subsoil thus laid bare is excavated at a slope not less than 1:3 (V:H) and deposited in the gully. This deposit is carefully compacted while in a moist state. The topsoil is now returned to the sloped area, and spread as evenly as possible over it. Vegetation suitable to the site is planted. The additional advantage to this idea is that, as the channel cross section is made shallower and wider and established to vegetation, so the chances of floodwaters overflowing into the adjacent flood area will be that much greater. Note that the base of the modified channel should be planted to strong, hydrophitic plants while the outer edges will require plants more suited to drier regimes. It must be emphasised that the stockpiling of the topsoil and its replacement is vital, especially where very erodible subsoil is present. Failure to do this will be tantamount to a waste of money and effort.

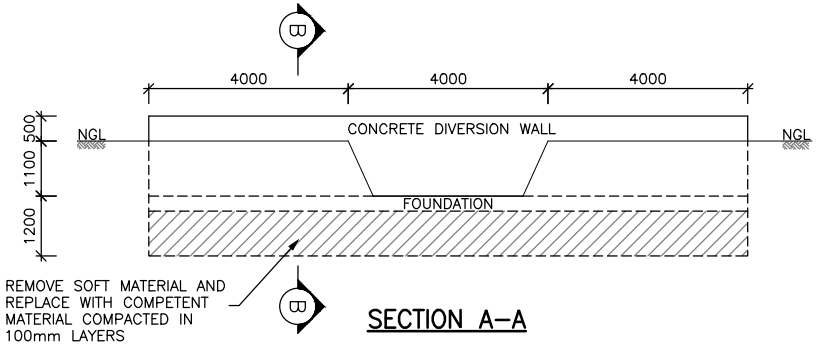
18. The orientation of all wetlands and interventions is to be taken facing downstream i.e. left bank and right bank are to be identified **facing downstream**.

19. The Bill of Quantities for the various rehabilitation interventions only included revegetation in those instances where the engineer considered the re-vegetation of the denuded area as important due to the size of the area affected or due to the risk associated with scouring and erosion.

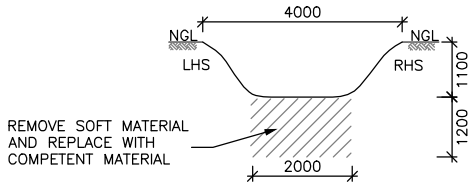
APPENDIX C – DESIGN DRAWINGS



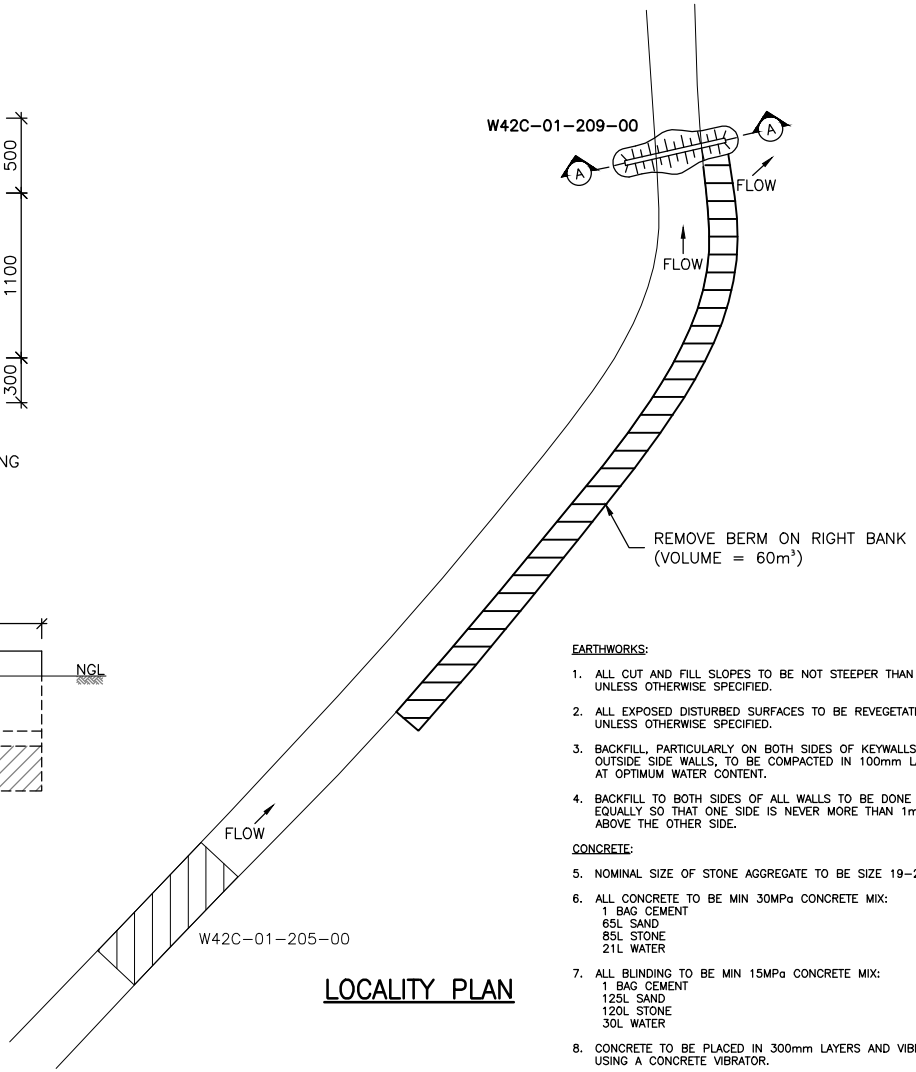
SECTION B–B



SECTION A–A



CROSS SECTION THROUGH CHANNEL



LOCALITY PLAN

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
3. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
4. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

CONCRETE:

5. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19–26mm.
6. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
   1 BAG CEMENT
   65L SAND
   85L STONE
   21L WATER
7. ALL BLINDING TO BE MIN 15MPa CONCRETE MIX:
   1 BAG CEMENT
   125L SAND
   120L STONE
   30L WATER
8. CONCRETE TO BE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
9. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING UNLESS OTHERWISE SPECIFIED.
10. NOT MORE THAN 1m DEPTH OF CONCRETE TO BE CAST PER DAY.
11. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

12. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
13. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
14. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METRE OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

NOTES

1. AURECON ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. NO GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON IS INDEMNIFIED BY THE CLIENT AND DOES NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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Working for Wetlands

aurecon

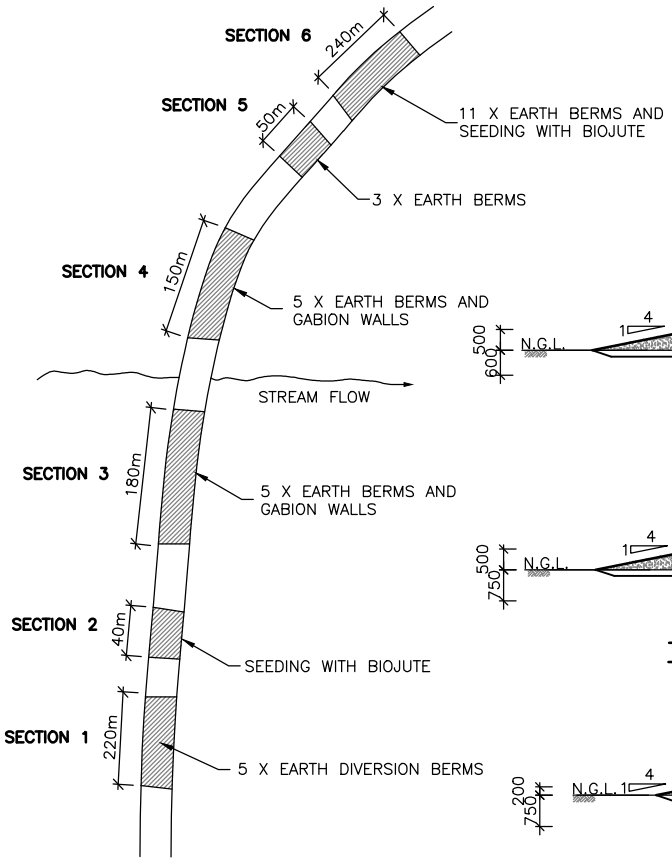
PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
CONCRETE DIVERSION BERM

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-01-209-00/01	A

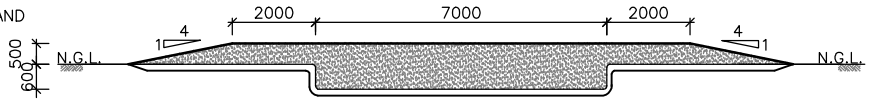
P:\PROJECTS\107406\ENGINEERING\13-INTERVENTIONS\W42C-01\W42C-01-209-00\2012_3_REHAB\DRAWINGS\W42C-01-209-00_01_REVA.DWG



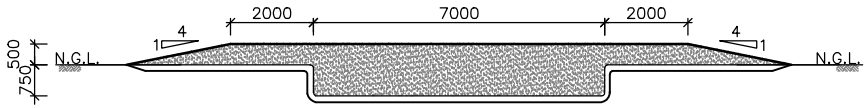
PLAN LAYOUT

NOTE: HEIGHT OF BERMS ABOVE SIDE BANKS TO BE 500mm HIGHER THAN LOWEST BANK ON THE SIDE WHERE WATER WILL BE DISCHARGING.

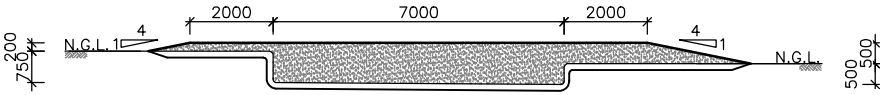
NOTE: SIDE BANKS TO BE SLOPED WHERE NECESSARY ALONG SECTIONS 1 TO 6.



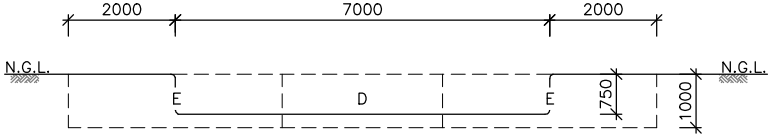
TYPICAL BERM DETAIL FOR SECTION 1



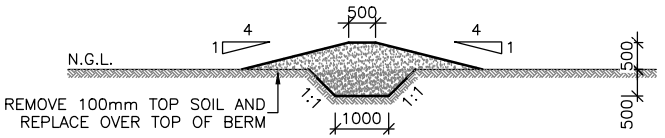
TYPICAL BERM DETAIL FOR SECTIONS 3, 4 & 5



TYPICAL BERM DETAIL FOR SECTION 6



TYPICAL SECTION THROUGH GABION WALL IN SECTION 3 & 4



TYPICAL CROSS SECTION THROUGH BERM

GABIONS:

1. GABION BASKETS AND RENO MATTRESSES TO BE CONSTRUCTED OF DOUBLE TWISTED, HEXAGONAL, PVC COATED, GALVANISED WIRE MESH OF NOMINAL DIAMETER 80mm MESH, WITH 3.4mm o/d FRAME WIRE AND 2.7mm o/d MESH WIRE WITH PARTITIONS AT 1m CENTRES.
2. GEOFABRIC TO BE NON-WOVEN, NOT LESS THAN 195g/m². e.g. AG200.
3. 100mm – 200mm STONE TO BE USED IN ALL GABIONS AND RENO MATTRESSES. STONE FILL MUST BE NON-FRIABLE & INSOLUBLE e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.
4. ALL GABIONS AND RENO MATTRESSES TO COMPLY WITH SANS-1200-DK.
5. CONCRETE CAPPING TO BE MINIMUM 15MPa & MIX:
   1 BAG CEMENT
   125L SAND
   120L STONE
   30L WATER
6. GEOFABRIC TO BE INSERTED AT ALL SOIL/MESH INTERFACES UNLESS OTHERWISE SPECIFIED.
7. GEOFABRIC TO HAVE WEEPHOLES PUNCHED THROUGH USING 10mm STEEL ROD AT APPROXIMATELY 4 HOLES/m².

EARTHWORKS:

8. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
9. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
10. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
11. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

12. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
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GABION & RENO MATTRESS SIZES

CODE	SIZE
A	1.0 x 1.0 x 1.0m
B	1.5 x 1.0 x 1.0m
C	2.0 x 1.0 x 1.0m
D	3.0 x 1.0 x 1.0m
E	4.0 x 1.0 x 1.0m
F	2.0 x 0.5 x 0.5m
G	2.0 x 1.0 x 0.5m
H	3.0 x 1.0 x 0.5m
J	4.0 x 1.0 x 0.5m
K	2.0 x 1.0 x 0.3m
L	3.0 x 1.0 x 0.3m
M	6.0 x 2.0 x 0.17m
N	6.0 x 2.0 x 0.23m
P	6.0 x 2.0 x 0.3m

NOTES

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
NEW ROAD AND SURFACE CROSS DRAINS

DATE	JULY 2012
DRAWN BY	B.MCCAROGHER
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-02-208-00/01	A

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

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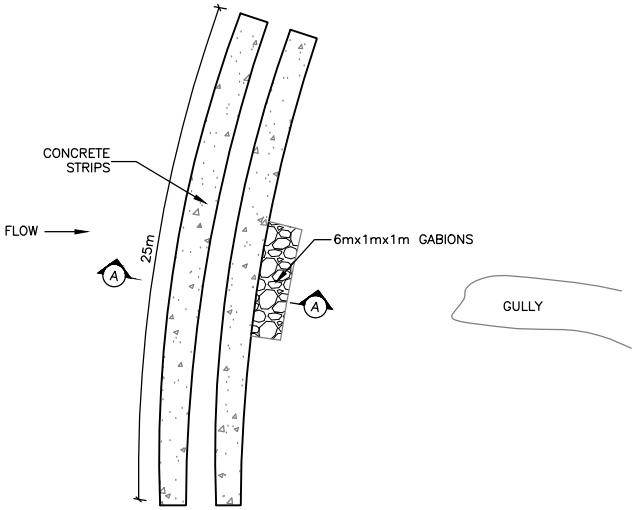

LOCALITY PLAN

CONCRETE:

1. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19–26mm.
2. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
   1 BAG CEMENT
   65L SAND
   85L STONE
   21L WATER
3. ALL BLINDING TO BE MIN 15MPa CONCRETE MIX:
   1 BAG CEMENT
   125L SAND
   120L STONE
   30L WATER
4. CONCRETE TO BE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
5. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING UNLESS OTHERWISE SPECIFIED.
6. NOT MORE THAN 1m DEPTH OF CONCRETE TO BE CAST PER DAY.
7. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

8. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
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EARTHWORKS:

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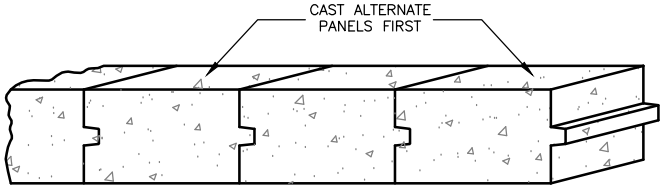
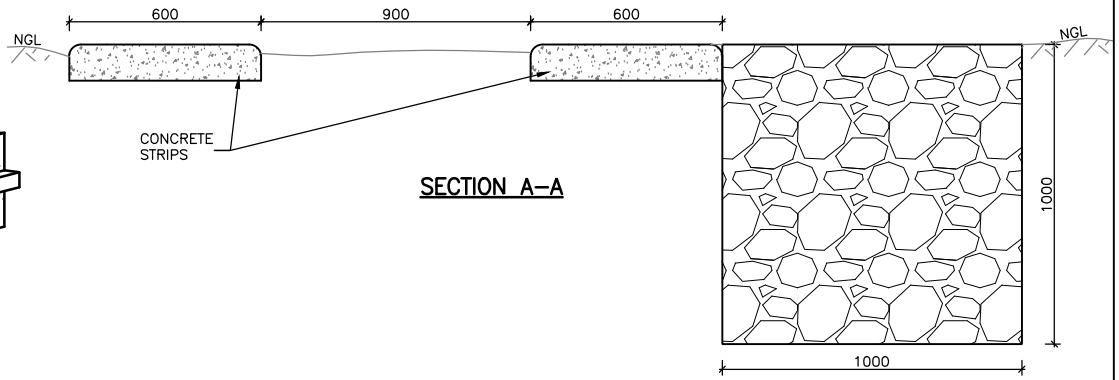
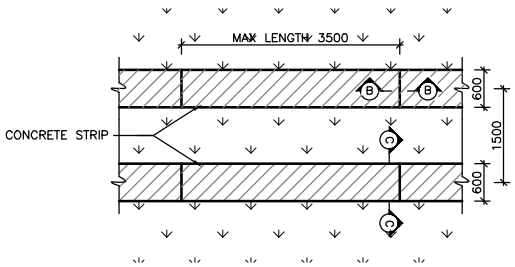


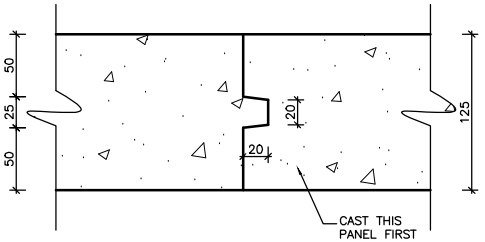
SCHEMATIC VIEW OF JOINT BETWEEN PANELS



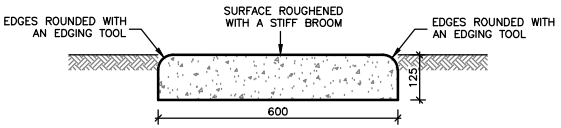
SECTION A–A



PLAN OF CONCRETE STRIP



SECTION B–B



SECTION C–C

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
CONCRETE STRIPS AND GABION PROTECTION

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–209–00/01	A

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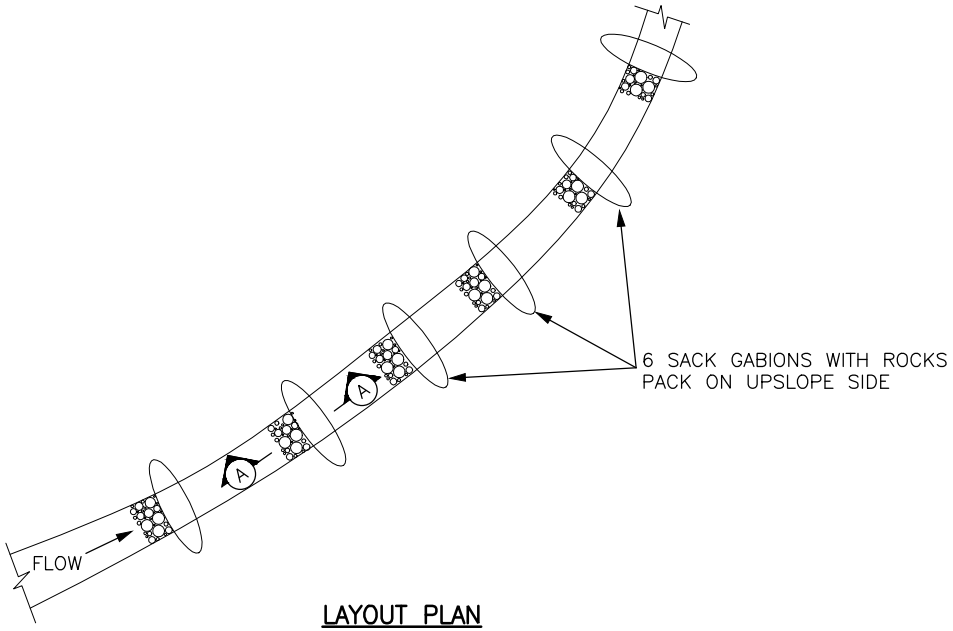
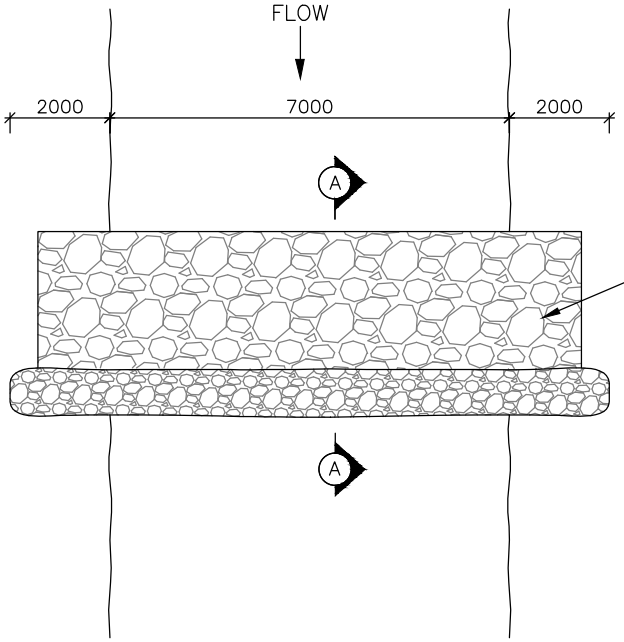
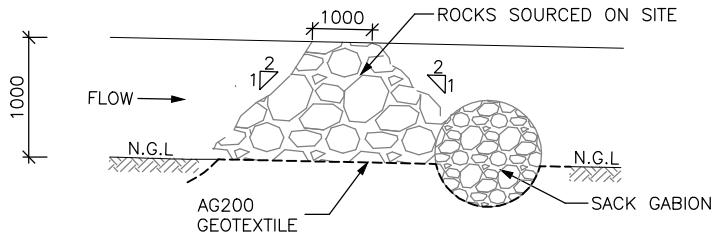


LAYOUT PLAN



PLAN



SECTION A–A

GABIONS:

1. GABION BASKETS AND RENO MATTRESSES TO BE CONSTRUCTED OF DOUBLE TWISTED, HEXAGONAL, PVC COATED, GALVANISED WIRE MESH OF NOMINAL DIAMETER 80mm MESH, WITH 3.4mm o/d FRAME WIRE AND 2.7mm o/d MESH WIRE WITH PARTITIONS AT 1m CENTRES.
2. GEOFABRIC TO BE NON–WOVEN, NOT LESS THAN 195g/m². e.g. AG200.
3. 100mm – 200mm STONE TO BE USED IN ALL GABIONS AND RENO MATTRESSES. STONE FILL MUST BE NON–FRIABLE & INSOLUBLE e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.
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5. CONCRETE CAPPING TO BE MINIMUM 15MPa & MIX:
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   125L SAND
   120L STONE
   30L WATER
6. GEOFABRIC TO BE INSERTED AT ALL SOIL/MESH INTERFACES UNLESS OTHERWISE SPECIFIED.
7. GEOFABRIC TO HAVE WEEPHOLES PUNCHED THROUGH USING 10mm STEEL ROD AT APPROXIMATELY 4 HOLES/m².

EARTHWORKS:

8. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
9. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
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NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
ROCKPACKS

DATE	JULY 2012
DRAWN BY	B.MCCAROGHER
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–211–00/01	A

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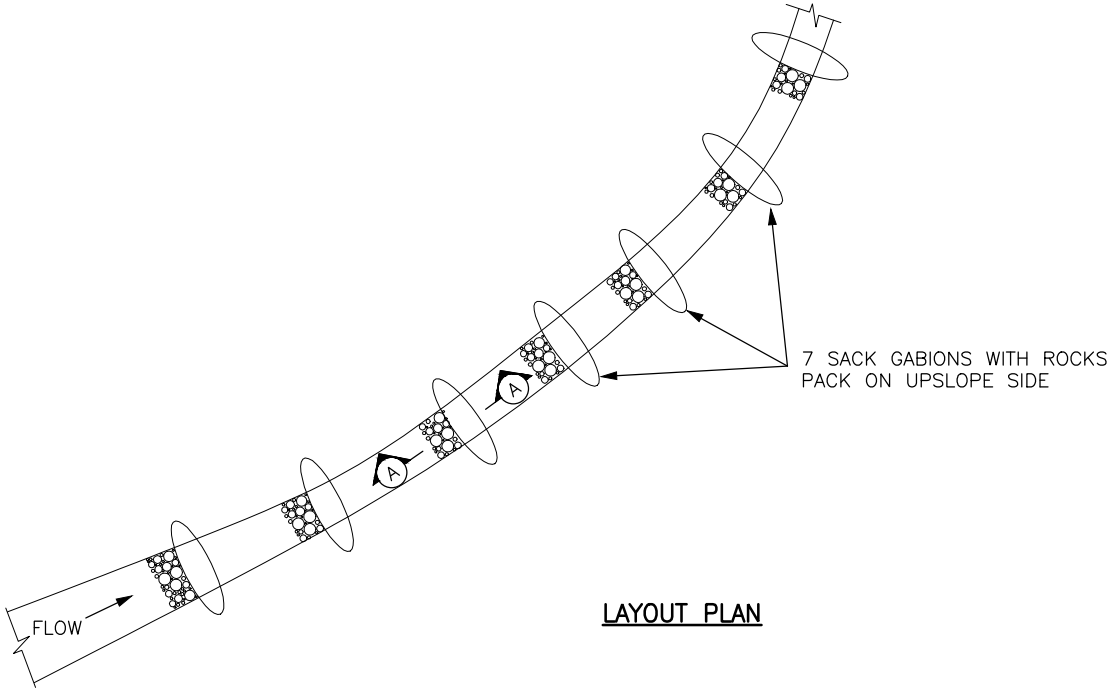
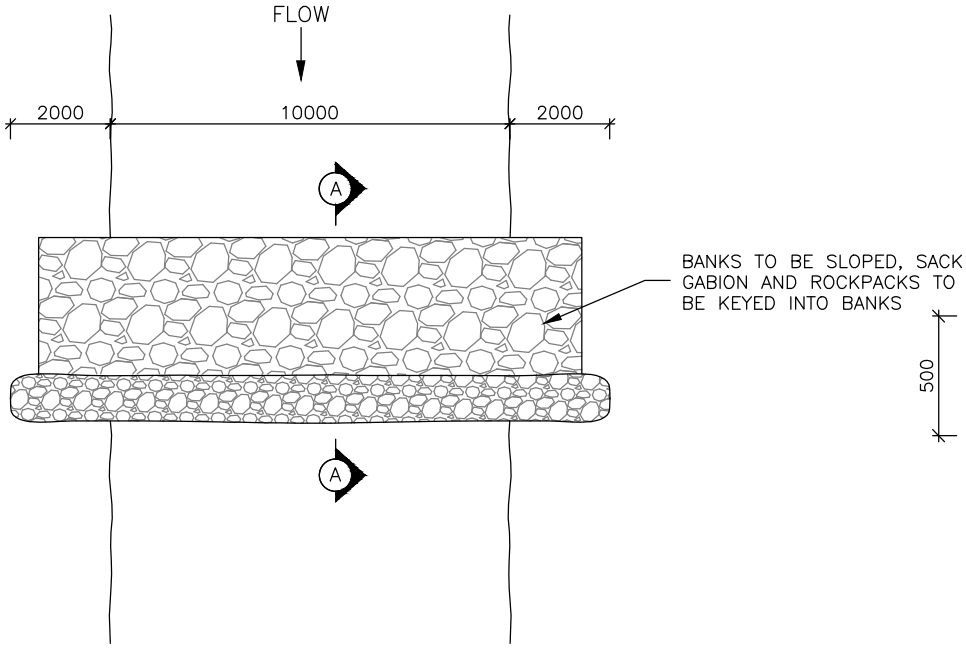
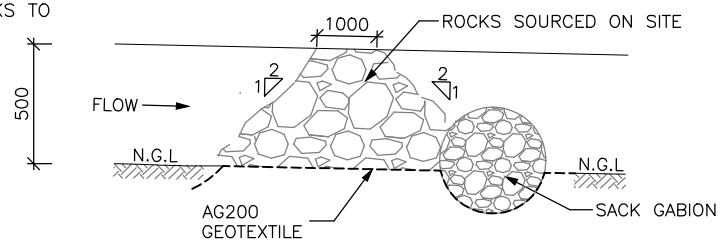


LAYOUT PLAN



PLAN



SECTION A–A

GABIONS:

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10. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
11. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

12. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
13. FILL MATERIAL TO BE GOOD QUALITY, WELL–GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
14. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE–USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METRE OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
ROCKPACKS

DATE	JULY 2012
DRAWN BY	B.MCCAROGHER
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–212–00/01	A

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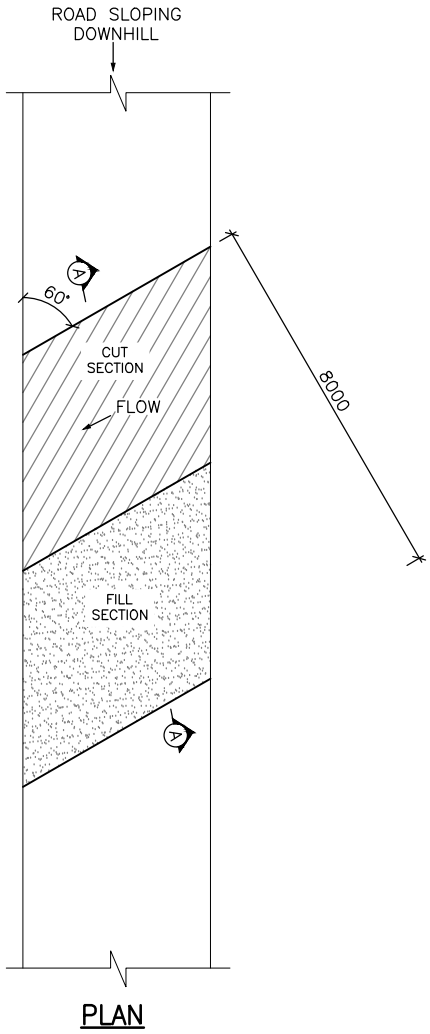

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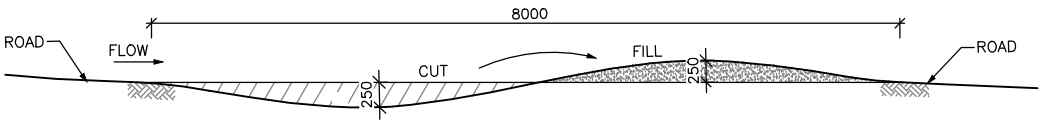

SECTION A–A

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

5. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
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7. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE–USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METRE OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

NOTE:

A TOTAL OF 16 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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Working for Wetlands

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PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–213–00/01	A

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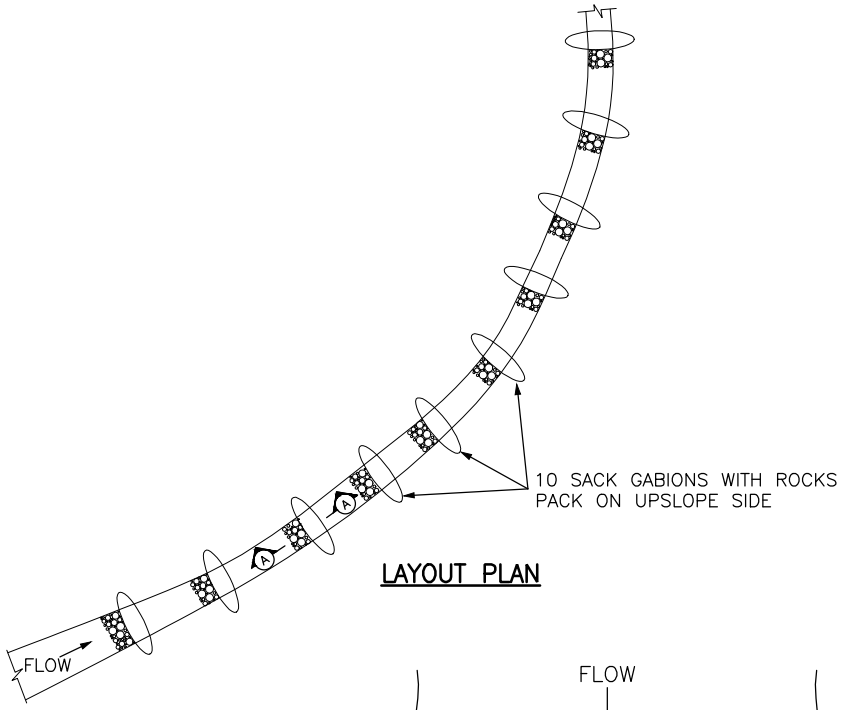
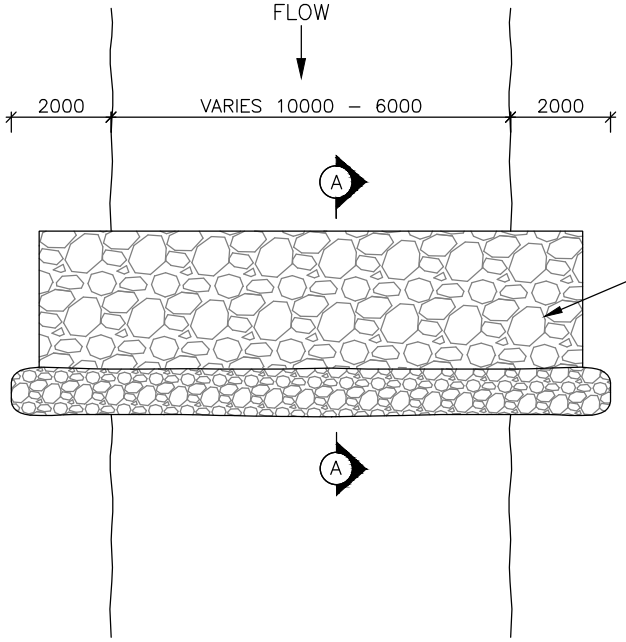


LAYOUT PLAN



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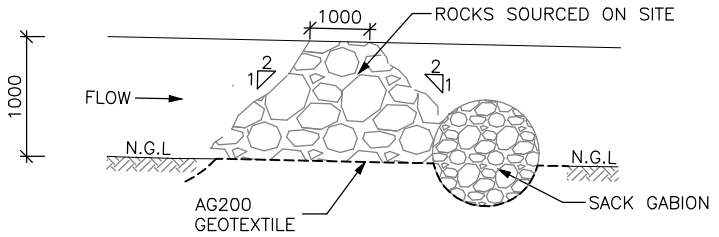

SECTION A–A

GABIONS:

1. GABION BASKETS AND RENO MATTRESSES TO BE CONSTRUCTED OF DOUBLE TWISTED, HEXAGONAL, PVC COATED, GALVANISED WIRE MESH OF NOMINAL DIAMETER 80mm MESH, WITH 3.4mm o/d FRAME WIRE AND 2.7mm o/d MESH WIRE WITH PARTITIONS AT 1m CENTRES.
2. GEOFABRIC TO BE NON–WOVEN, NOT LESS THAN 195g/m². e.g. AG200.
3. 100mm – 200mm STONE TO BE USED IN ALL GABIONS AND RENO MATTRESSES. STONE FILL MUST BE NON–FRIABLE & INSOLUBLE e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.
4. ALL GABIONS AND RENO MATTRESSES TO COMPLY WITH SANS–1200–DK.
5. CONCRETE CAPPING TO BE MINIMUM 15MPa & MIX:
   1 BAG CEMENT
   125L SAND
   120L STONE
   30L WATER
6. GEOFABRIC TO BE INSERTED AT ALL SOIL/MESH INTERFACES UNLESS OTHERWISE SPECIFIED.
7. GEOFABRIC TO HAVE WEEPHOLES PUNCHED THROUGH USING 10mm STEEL ROD AT APPROXIMATELY 4 HOLES/m².

EARTHWORKS:

8. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
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DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
ROCKPACKS

DATE	JULY 2012
DRAWN BY	B.MCCAROGHER
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–215–00/01	A

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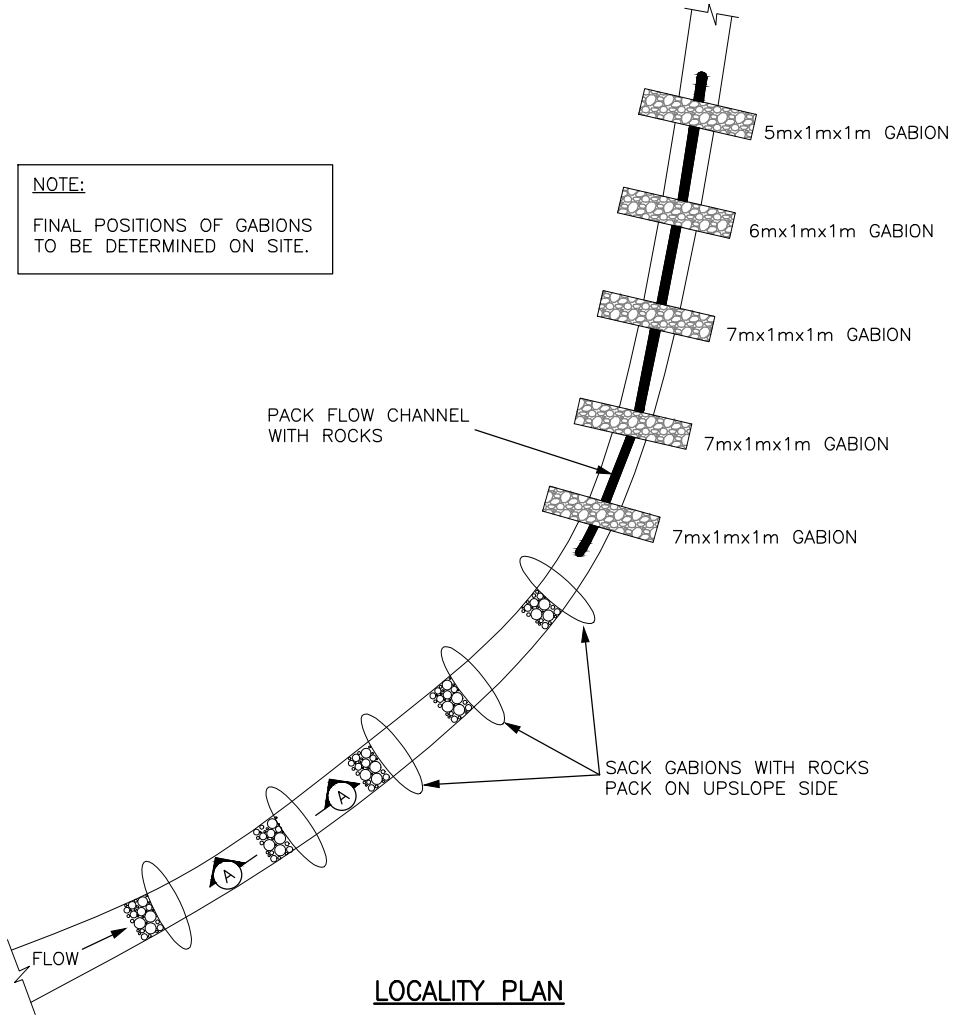
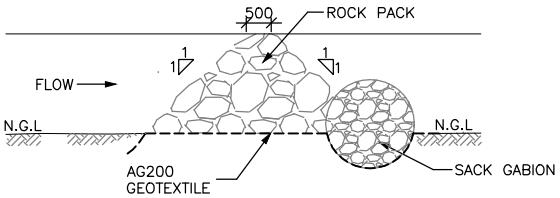
NOTE:

FINAL POSITIONS OF GABIONS TO BE DETERMINED ON SITE.



LOCALITY PLAN



SECTION A–A

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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
GULLY STABILIZATION

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–216–00/01	A

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

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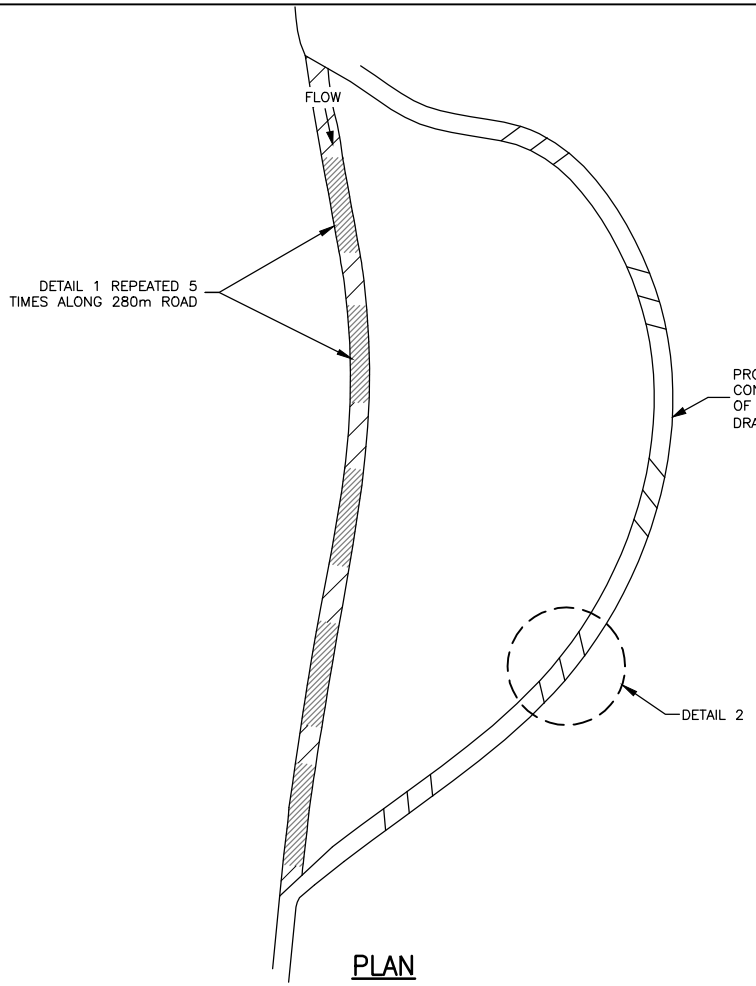
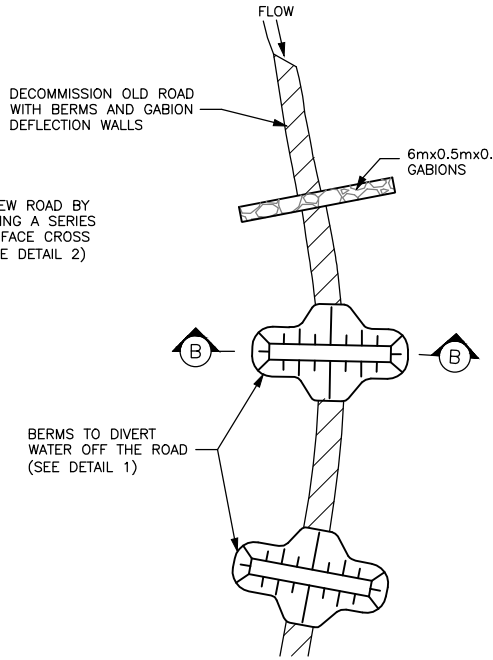
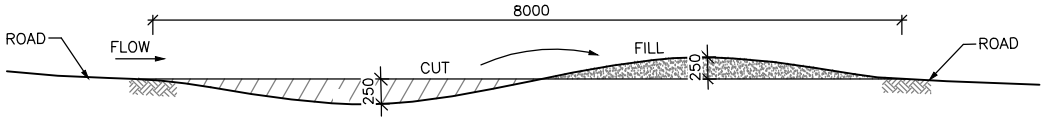
NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.



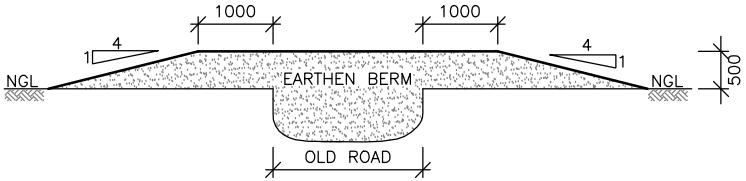
PLAN



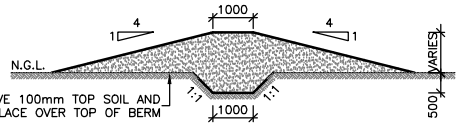
DETAIL 1



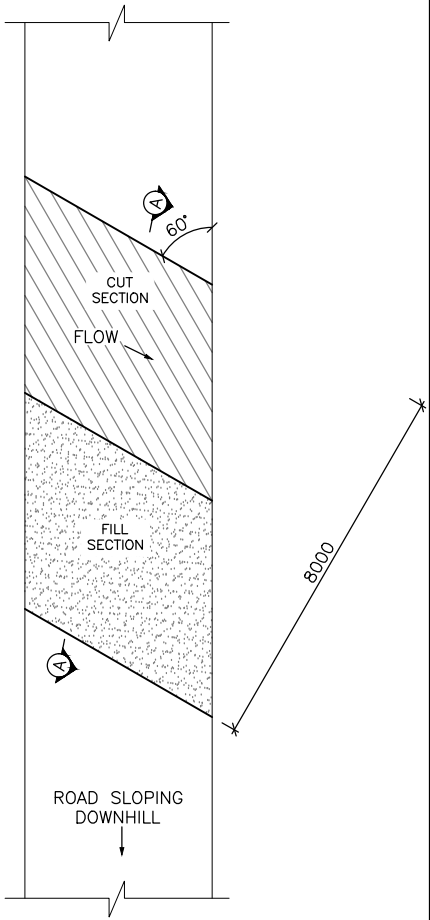
SECTION A–A



SECTION B–B



TYPICAL CROSS SECTION THROUGH BERM



DETAIL 2: PLAN OF SURFACE DRAIN

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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
NEW ROAD AND SURFACE CROSS DRAINS

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-02-217-00/01	A

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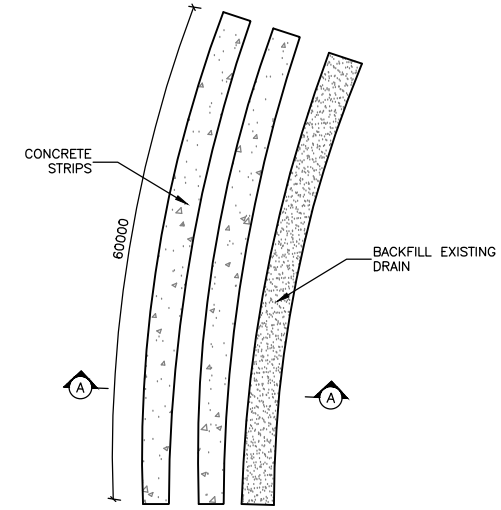
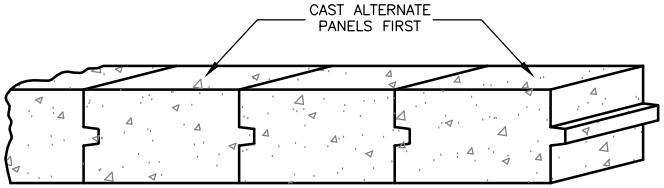
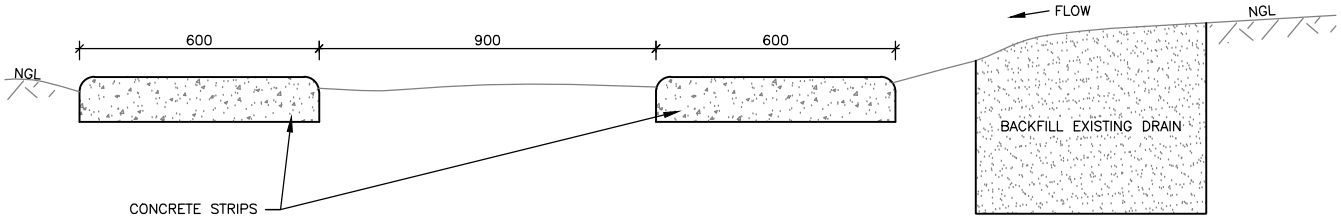


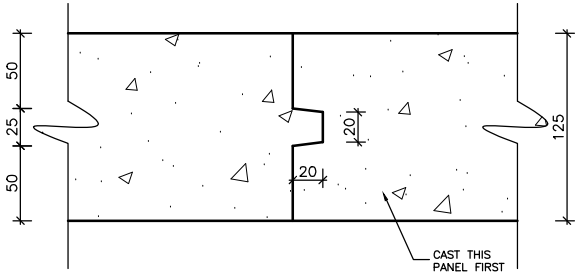
LOCALITY PLAN



SCHEMATIC VIEW OF JOINT BETWEEN PANELS



SECTION A–A



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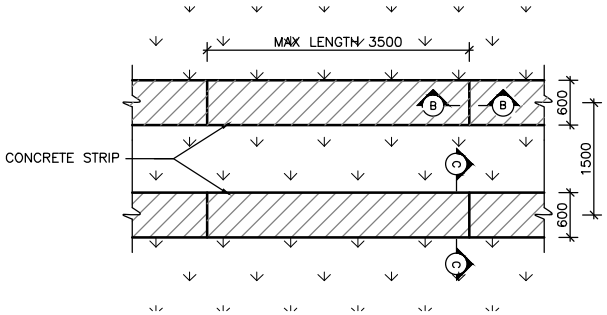
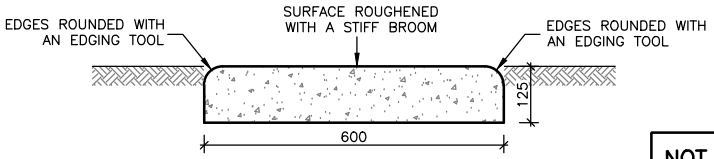


PLAN OF CONCRETE STRIP



SECTION C–C

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
3. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
4. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

CONCRETE:

5. NOMINAL SIZE OF STONE AGGREGATE TO BE SIZE 19–26mm.
6. ALL CONCRETE TO BE MIN 30MPa CONCRETE MIX:
   1 BAG CEMENT
   65L SAND
   85L STONE
   21L WATER
7. ALL BLINDING TO BE MIN 15MPa CONCRETE MIX:
   1 BAG CEMENT
   125L SAND
   120L STONE
   30L WATER
8. CONCRETE TO BE PLACED IN 300mm LAYERS AND VIBRATED USING A CONCRETE VIBRATOR.
9. MIN 50mm COVER REQUIRED ON ALL CONCRETE REINFORCING UNLESS OTHERWISE SPECIFIED.
10. NOT MORE THAN 1m DEPTH OF CONCRETE TO BE CAST PER DAY.
11. ALL CONCRETE WALLS TO BE FULLY SUPPORTED UNTIL THEY ARE BACKFILLED TO THE DESIGNED LEVEL.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

12. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
13. FILL MATERIAL TO BE GOOD QUALITY, WELL–GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
14. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE–USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METRE OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

NOTES

1. AURECON ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. NO GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON–STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON IS INDEMNIFIED BY THE CLIENT AND DOES NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
CONCRETE STRIPS AND BACKFILL EXISTING DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–218–00/01	A

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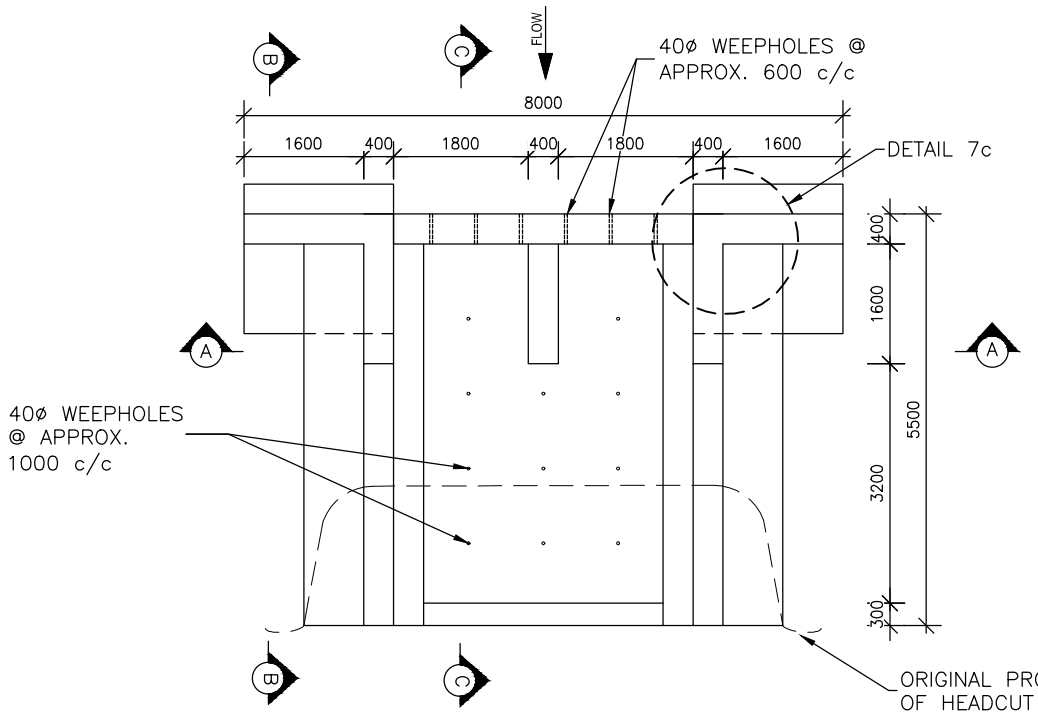
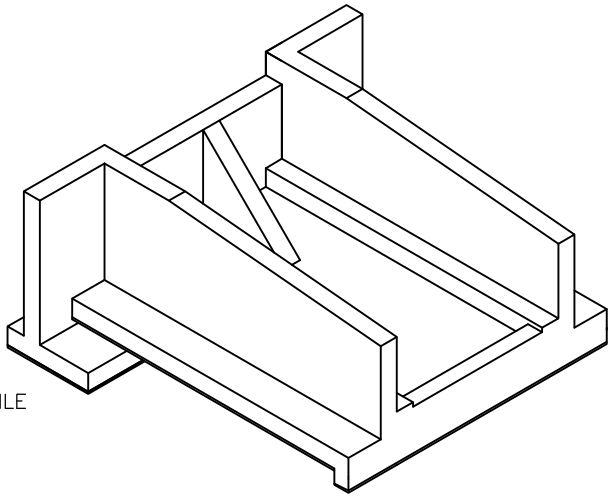
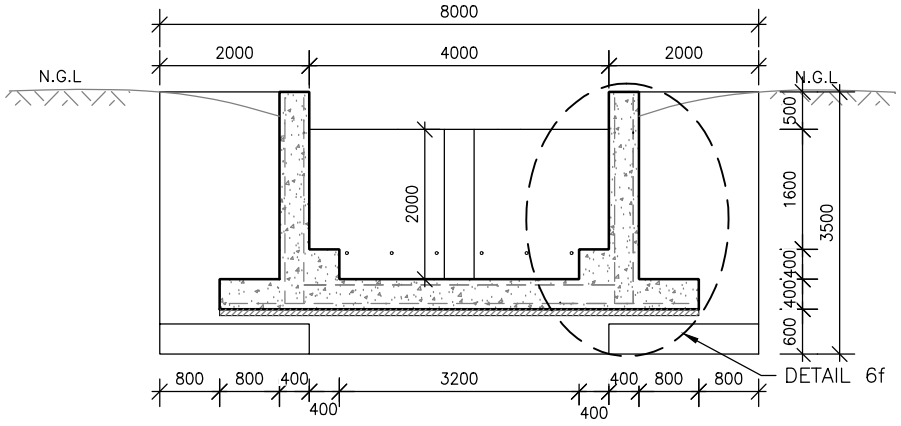


PLAN VIEW



ISOMETRIC VIEW



SECTION A–A

NOTE: STRUCTURE TO BE SET INTO HEADCUT TO CREATE SPACE FOR CONSTRUCTION OF APRON SLAB.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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Working for Wetlands

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PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
CONCRETE WEIR

DATE	JULY 2012
DRAWN BY	D.RAJNA
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-02-219-00/01	A

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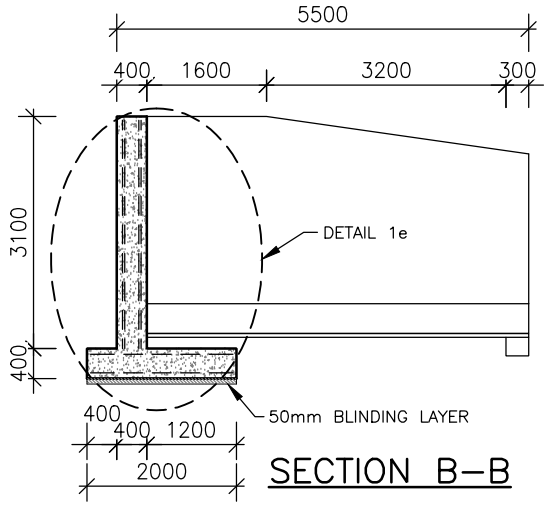
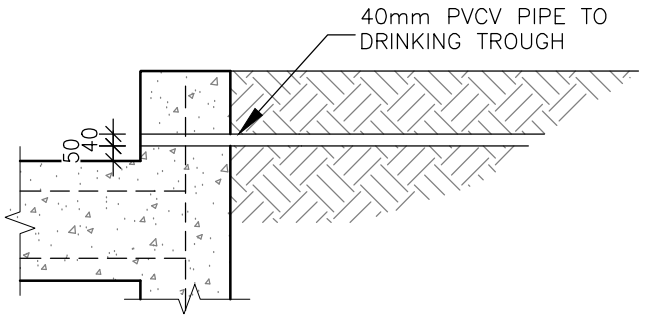
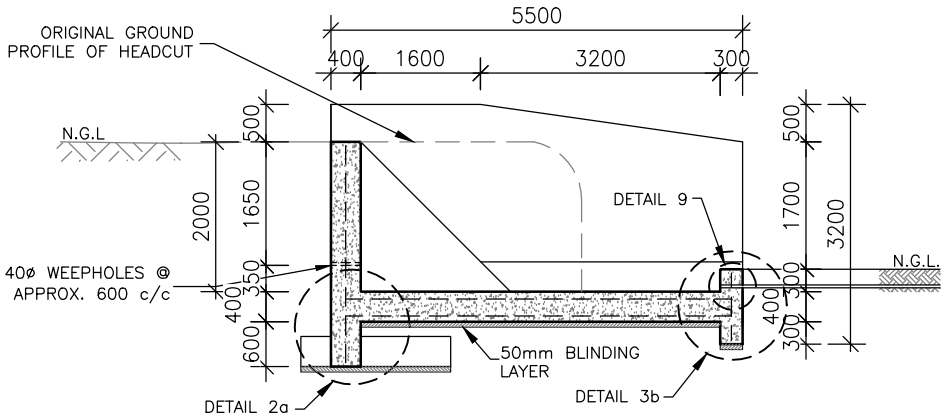
DETAIL No.	SHEET No.	DESCRIPTION
-	SHEET 02	TYPICAL WEEPHOLE DETAIL
-	SHEET 02	TYPICAL CONSTRUCTION JOINT DETAIL
-	SHEET 02	STANDARD NOTES FOR CONCRETE WEIRS
-	SHEET 03	REBAR DETAIL
1e	SHEET 05	KEY WALL DETAILS
2a	SHEET 06	SPILLWAY DETAILS
3b	SHEET 06	CUT-OFF WALL DETAILS
6f	SHEET 09	SHOULDER WALL DETAILS
7c	SHEET 12	SPILLWAY CORNER DETAILS



SECTION B–B



DETAIL 9



SECTION C–C

NOTE:

4.0m x 4.0m CONCRETE CAPPED RENO MATTRESS TO BE INSTALLED AROUND THE DRINKING WATER TROUGH.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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PROJECT

WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION

CONCRETE WEIR

DATE	JULY 2012
DRAWN BY	D.RAJNA
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-02-219-00/02	A

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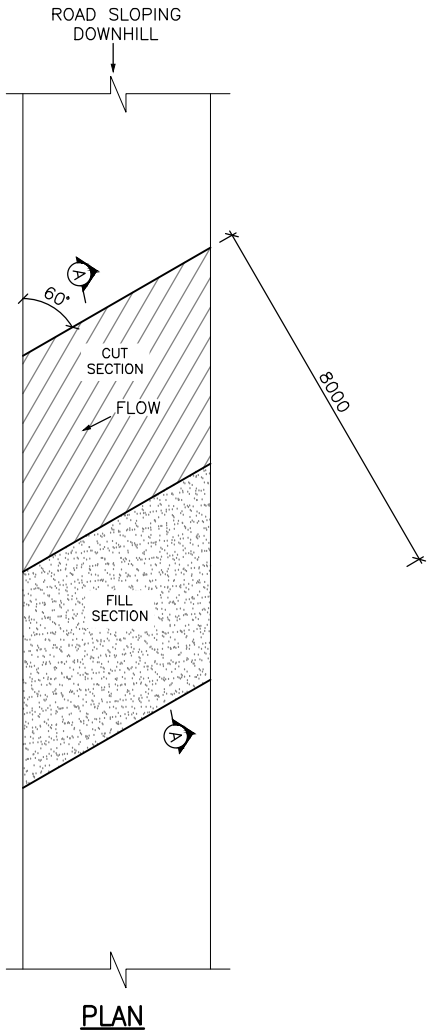
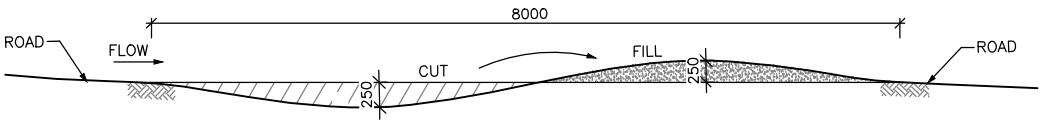


PLAN



SECTION A–A

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
3. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
4. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

5. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
6. FILL MATERIAL TO BE GOOD QUALITY, WELL–GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
7. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE–USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METRE OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

NOTE:

A TOTAL OF 21 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

1. AURECON ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. NO GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON–STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON IS INDEMNIFIED BY THE CLIENT AND DOES NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–220–00/01	A

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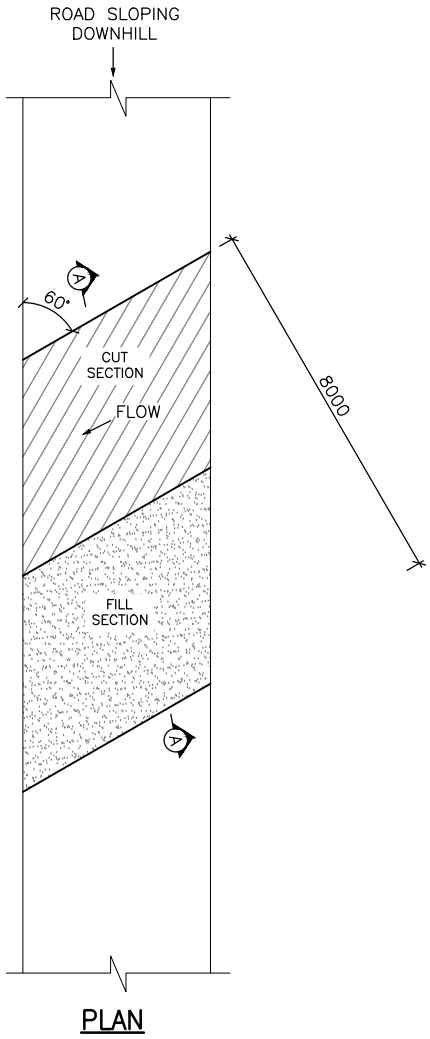

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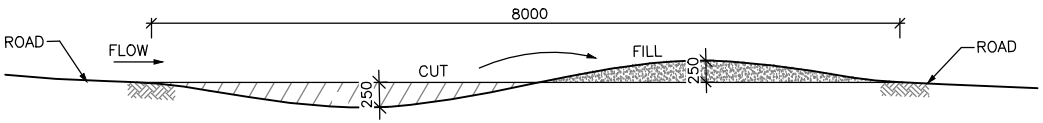

SECTION A–A

EARTHWORKS:

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2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
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DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

5. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
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NOTE:

A TOTAL OF 9 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–221–00/01	A

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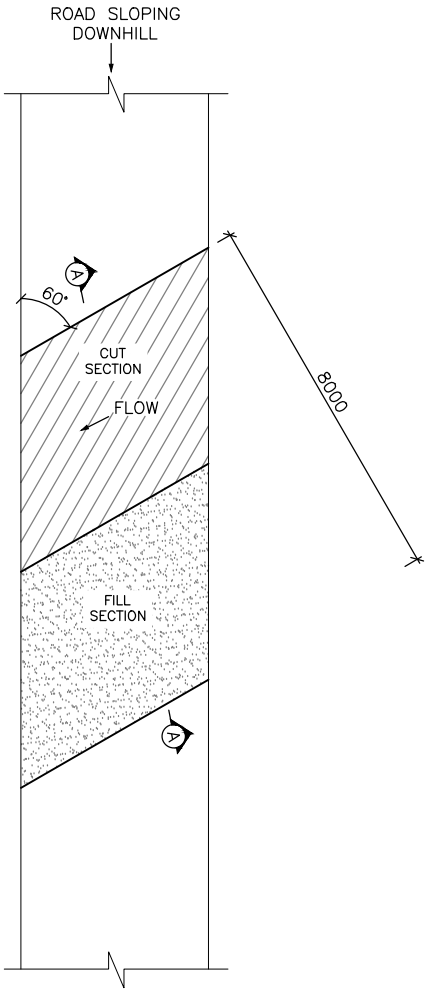

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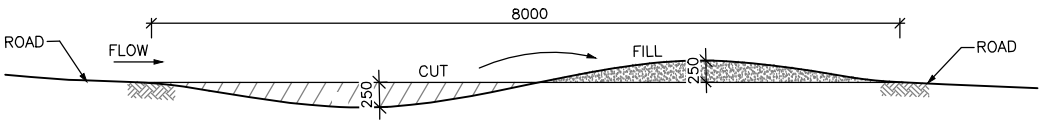

SECTION A–A

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
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DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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NOTE:

A TOTAL OF 5 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–222–00/01	A

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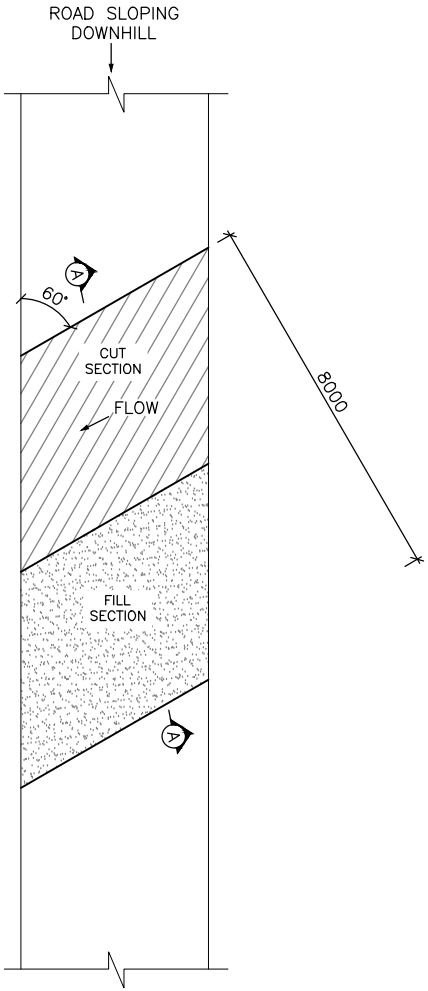
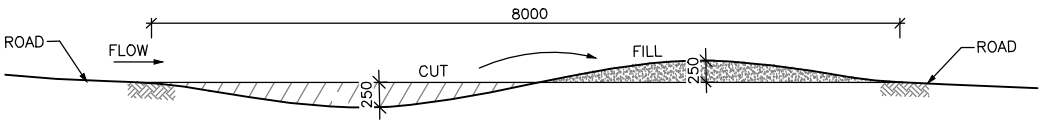


PLAN



SECTION A–A

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NOTE:

A TOTAL OF 4 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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Working for Wetlands

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PROJECT

WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION

SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–223–00/01	A

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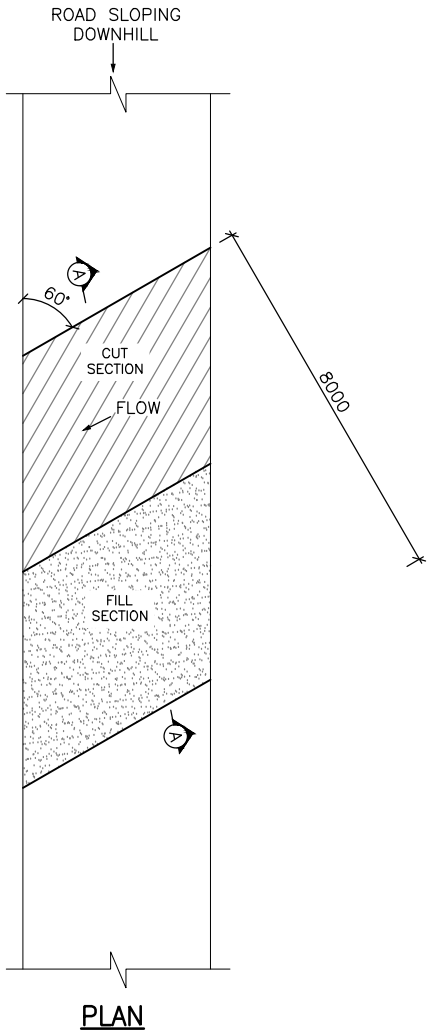

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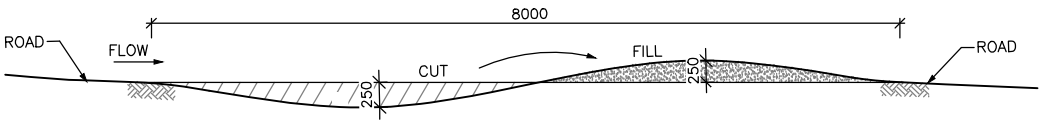

SECTION A–A

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
3. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
4. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

5. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
6. FILL MATERIAL TO BE GOOD QUALITY, WELL–GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
7. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE–USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METRE OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

NOTE:
A TOTAL OF 3 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

1. AURECON ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. NO GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON–STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON IS INDEMNIFIED BY THE CLIENT AND DOES NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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Working for Wetlands

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PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–224–00/01	A

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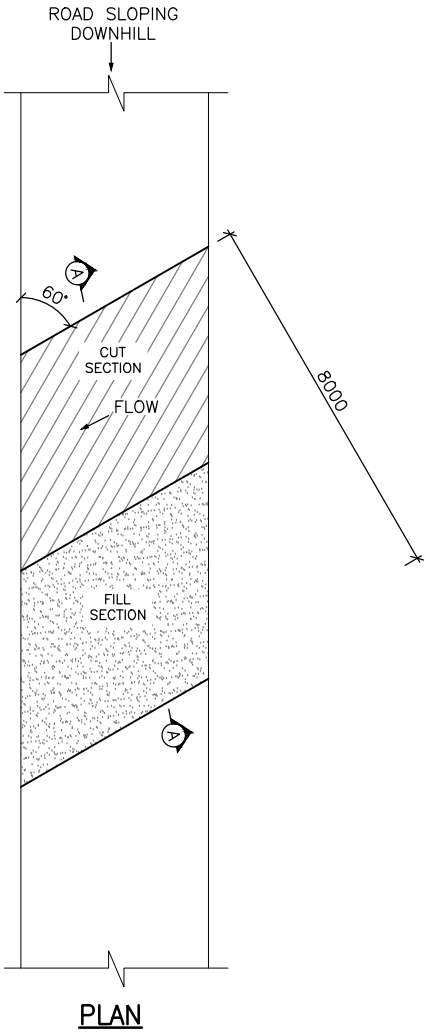

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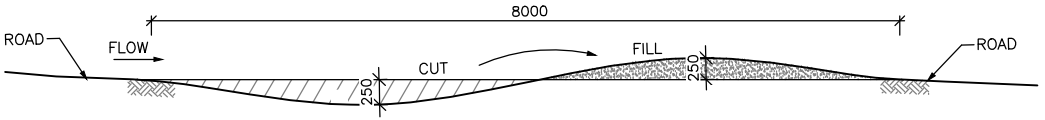

SECTION A–A

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
3. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
4. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

5. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
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NOTE:

A TOTAL OF 14 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–225–00/01	A

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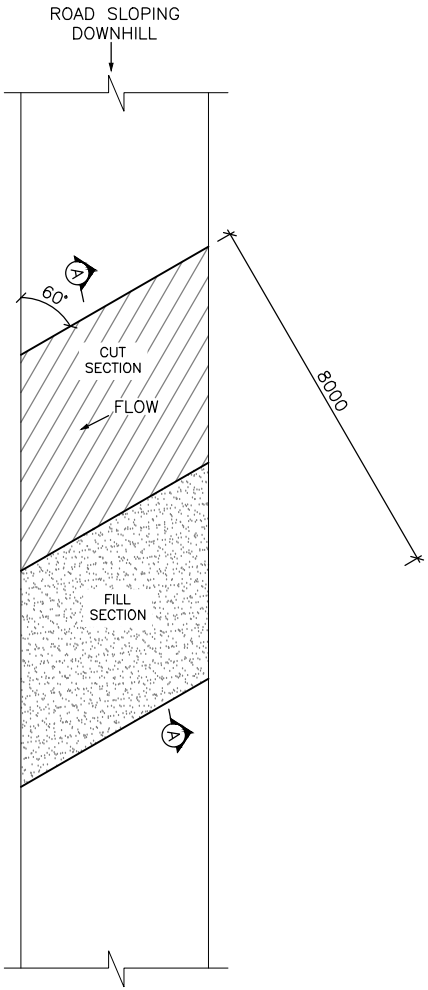

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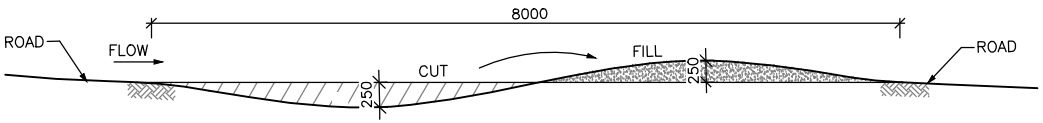

SECTION A–A

EARTHWORKS:

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2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
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DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

5. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
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NOTE:

A TOTAL OF 32 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–226–00/01	A

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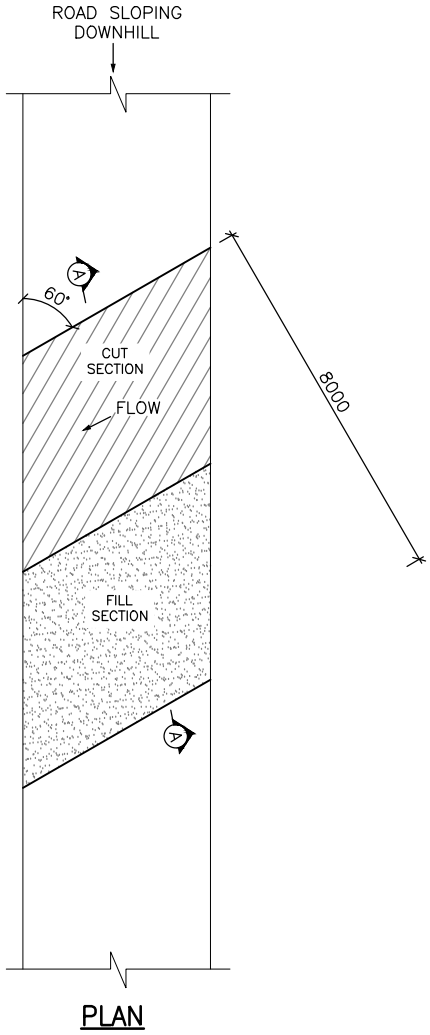

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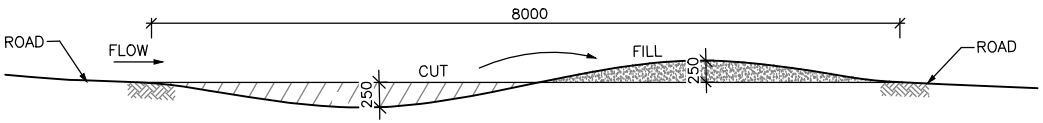

SECTION A–A

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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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NOTE:
A TOTAL OF 24 SURFACE CROSS DRAINS TO BE CONSTRUCTED AT 20m INTERVALS ON STEEP SECTIONS TO DIVERT WATER OFF THE ROAD.

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NOTES
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Working for Wetlands

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PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
SURFACE CROSS DRAIN

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C–02–227–00/01	A

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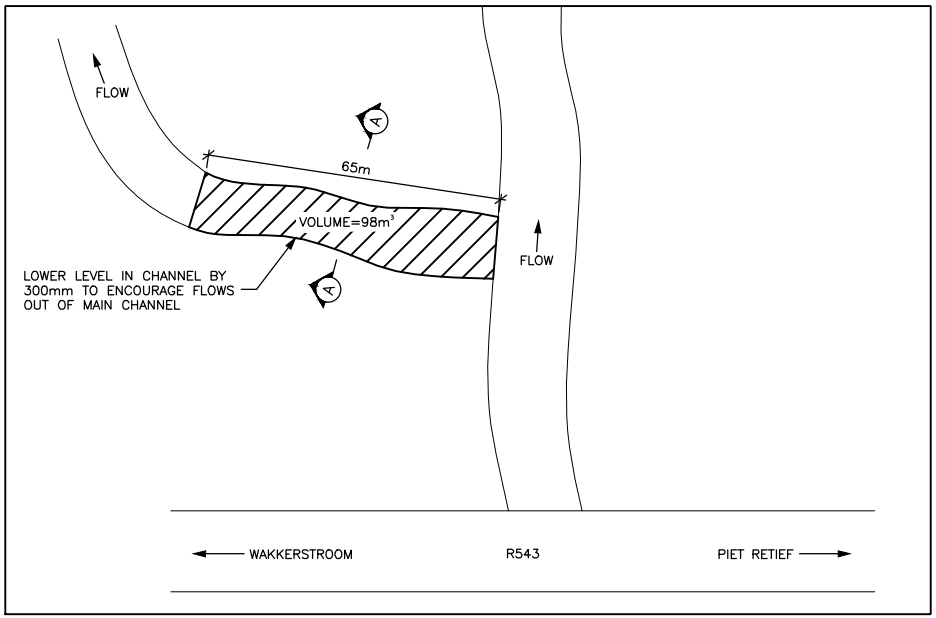
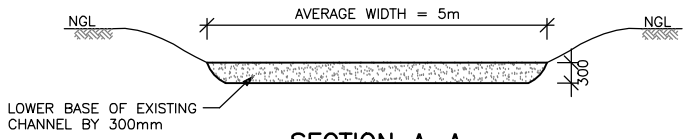


LOCALITY PLAN



SECTION A–A

EARTHWORKS:

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DISPERSIVE SOILS:
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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
EXCAVATION OF
EXISTING CHANNEL

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
V31A–01–201–00/01	A

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

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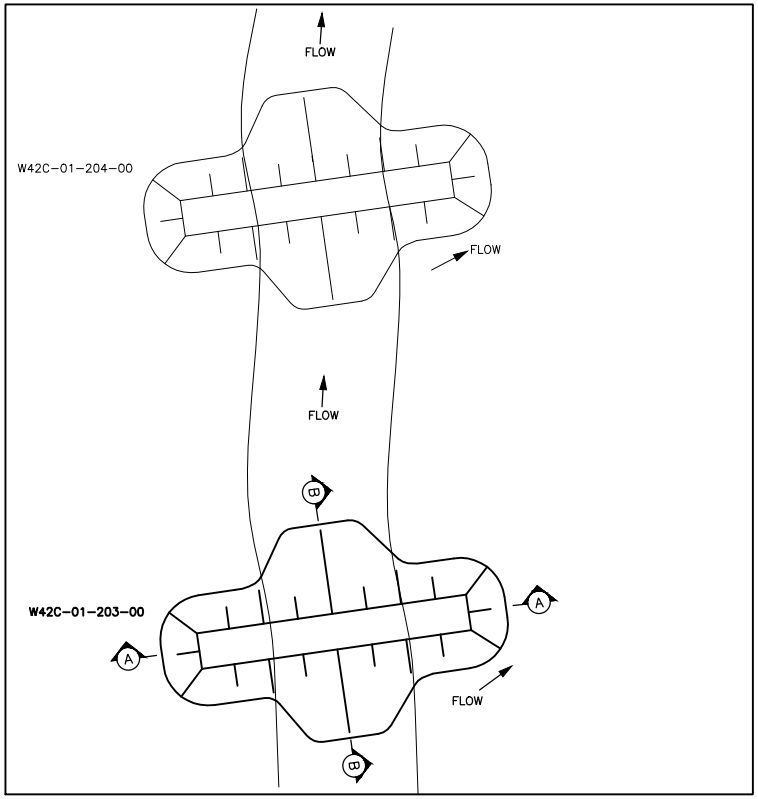
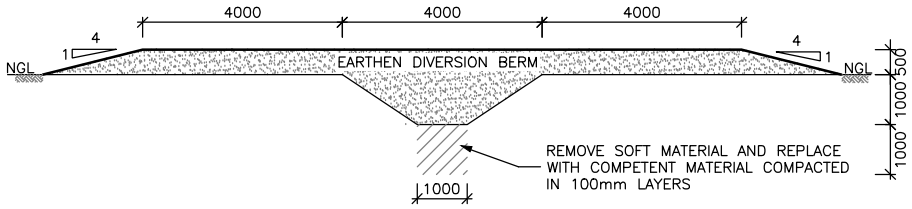
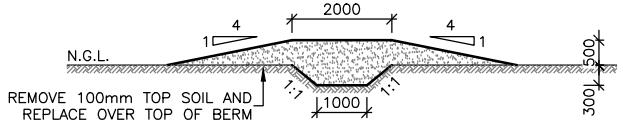


LOCALITY PLAN



SECTION A–A



SECTION B–B

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
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DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
EARTHEN DIVERSION BERM

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-01-203-00/01	A

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

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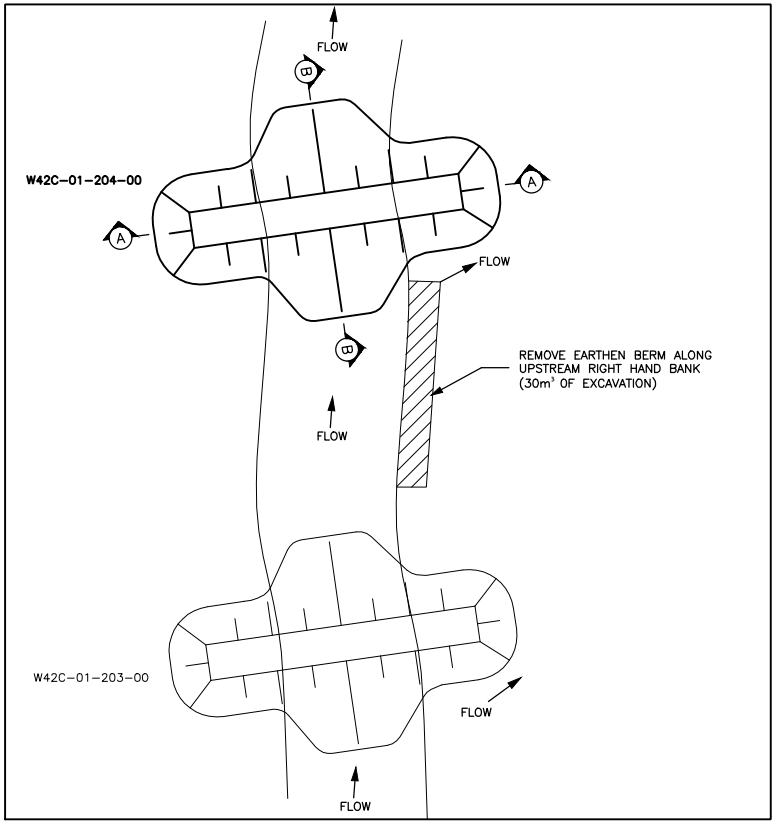
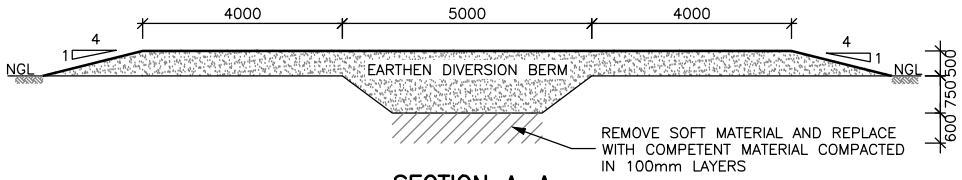
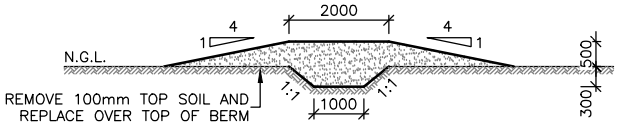


LOCALITY PLAN



SECTION A–A



SECTION B–B

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
3. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
4. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

5. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
6. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
7. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METRE OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

NOTES

1. AURECON ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. NO GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON-STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON IS INDEMNIFIED BY THE CLIENT AND DOES NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

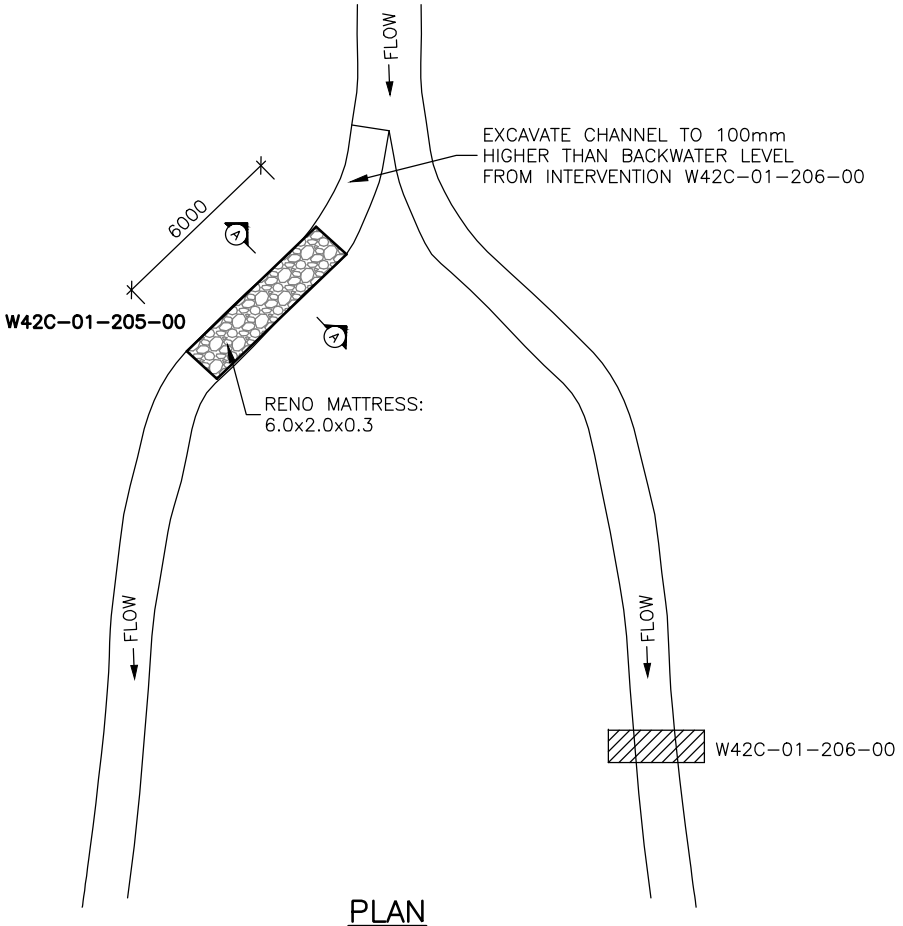
DRAWING DESCRIPTION
EARTHEN DIVERSION BERM

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

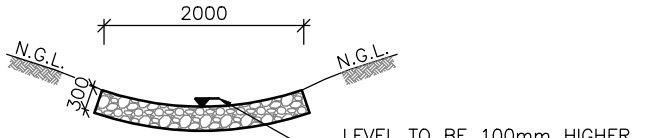
DRAWING No.	REV No.
W42C-01-204-00/01	A

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

P:\PROJECTS\107406\ENGINEERING\13-INTERVENTIONS\W42C-01\W42C-01-204-00\2012_3_REHAB\DRAWINGS\W42C-01-204-00_01_REVA.DWG



PLAN



SECTION A-A

GABIONS:

1. GABION BASKETS AND RENO MATTRESSES TO BE CONSTRUCTED OF DOUBLE TWISTED, HEXAGONAL, PVC COATED, GALVANISED WIRE MESH OF NOMINAL DIAMETER 80mm MESH, WITH 3.4mm o/d FRAME WIRE AND 2.7mm o/d MESH WIRE WITH PARTITIONS AT 1m CENTRES.

2. GEOFABRIC TO BE NON-WOVEN, NOT LESS THAN 195g/m². e.g. AG200.

3. 100mm – 200mm STONE TO BE USED IN ALL GABIONS AND RENO MATTRESSES. STONE FILL MUST BE NON-FRIABLE & INSOLUBLE e.g. GRANITE, BASALT, LIMESTONE OR SANDSTONE.

4. ALL GABIONS AND RENO MATTRESSES TO COMPLY WITH SANS-1200-DK.

5. CONCRETE CAPPING TO BE MINIMUM 15MPa & MIX:
   1 BAG CEMENT
   125L SAND
   120L STONE
   30L WATER

6. GEOFABRIC TO BE INSERTED AT ALL SOIL/MESH INTERFACES UNLESS OTHERWISE SPECIFIED.

7. GEOFABRIC TO HAVE WEEPHOLES PUNCHED THROUGH USING 10mm STEEL ROD AT APPROXIMATELY 4 HOLES/m².

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(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

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Working for Wetlands

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PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
RENO MATTRESS

DATE	JULY 2012
DRAWN BY	B.MCCAROGHER
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-01-205-00/01	A

NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

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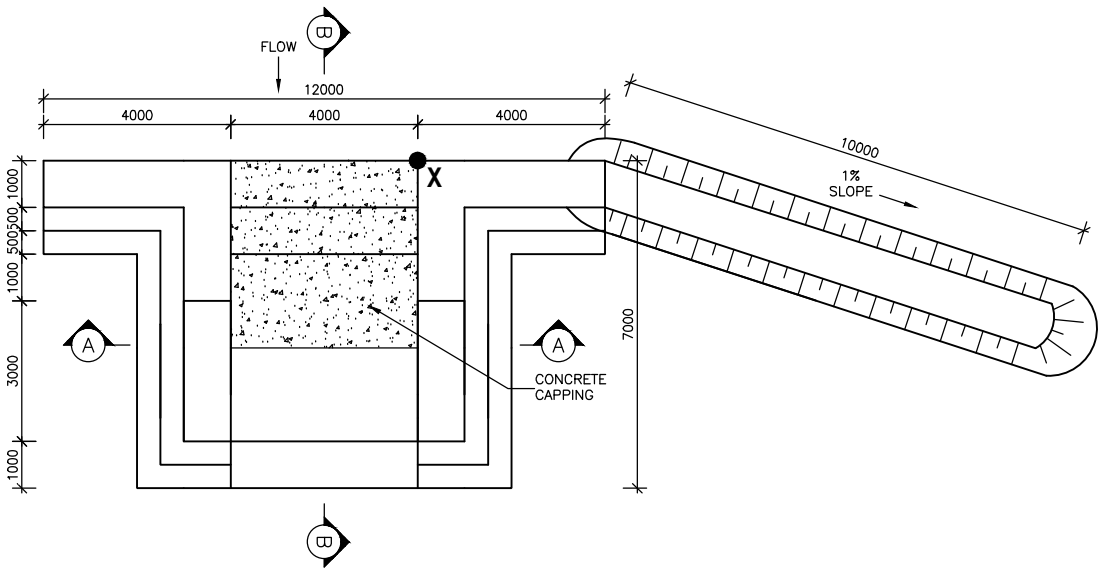
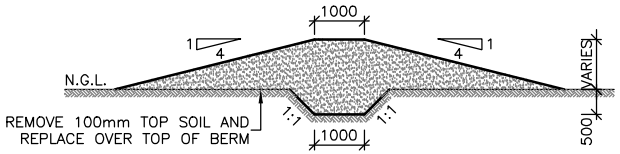
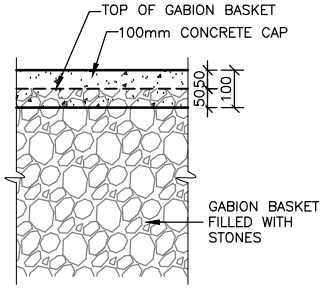


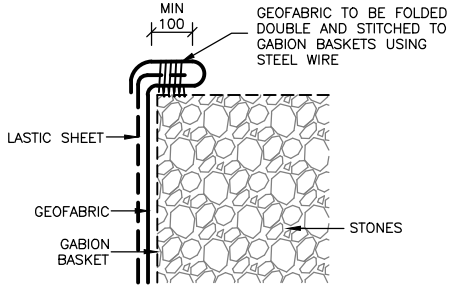
GABION QUANTITIES	
CODE	NO. BASKETS
B	18
C	2
D	16
E	4
H	2
J	3
K	7
L	10
P	6



TYPICAL CROSS SECTION THROUGH BERM



TYPICAL DETAIL OF CONCRETE CAPPING FOR GABIONS & RENO MATTRESSES



TYPICAL DETAIL FOR TYING OF GEOFABRIC TO GABIONS & RENO MATTRESSES WITH PLASTIC SHEET

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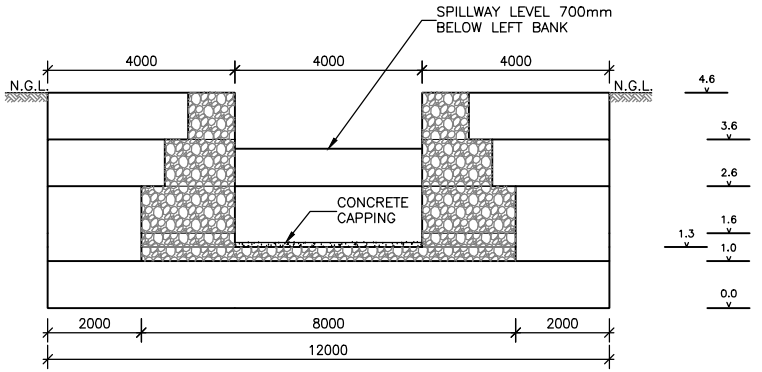
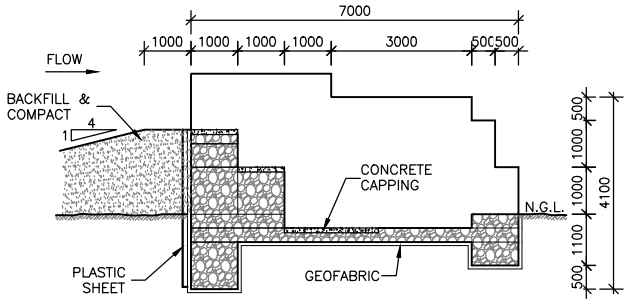


SECTION A–A



SECTION B–B

NOTES

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Working for Wetlands

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PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
GABION WEIR:
LEVELS & DETAILS

DATE	JULY 2012
DRAWN BY	D.RAJNA
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-01-206-00/01	A

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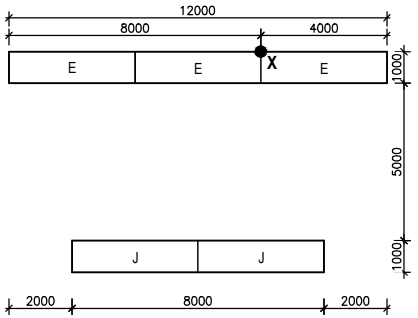
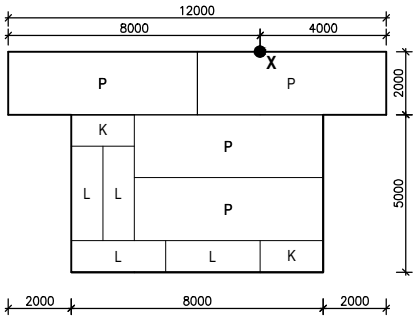
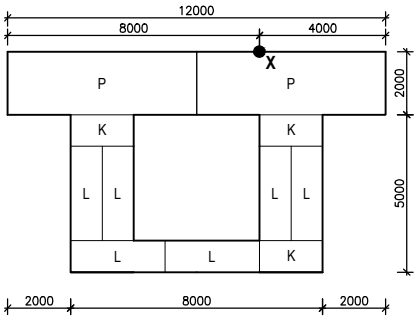


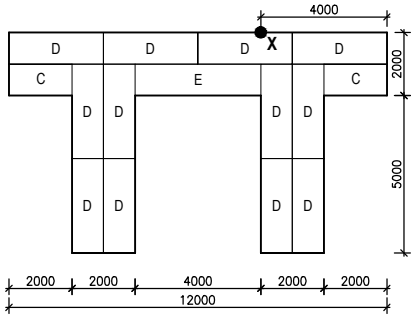
LEVEL 1.0m



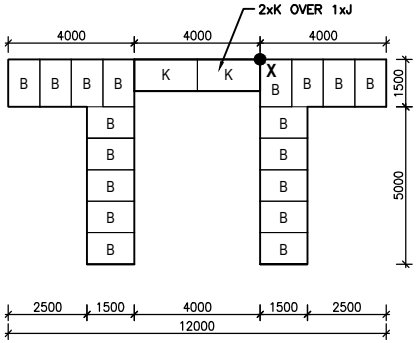
LEVEL 1.3m



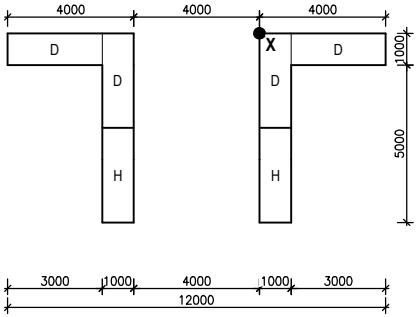
LEVEL 1.6m



LEVEL 2.6m



LEVEL 3.6m



LEVEL 4.6m

GABIONS:

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4. ALL GABIONS AND RENO MATTRESSES TO COMPLY WITH SANS-1200-DK.
5. CONCRETE CAPPING TO BE MINIMUM 15MPa & MIX:
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   30L WATER
6. GEOFABRIC TO BE INSERTED AT ALL SOIL/MESH INTERFACES UNLESS OTHERWISE SPECIFIED.
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GABION & RENO MATTRESS SIZES

CODE	SIZE
A	1.0 x 1.0 x 1.0m
B	1.5 x 1.0 x 1.0m
C	2.0 x 1.0 x 1.0m
D	3.0 x 1.0 x 1.0m
E	4.0 x 1.0 x 1.0m
F	2.0 x 0.5 x 0.5m
G	2.0 x 1.0 x 0.5m
H	3.0 x 1.0 x 0.5m
J	4.0 x 1.0 x 0.5m
K	2.0 x 1.0 x 0.3m
L	3.0 x 1.0 x 0.3m
M	6.0 x 2.0 x 0.17m
N	6.0 x 2.0 x 0.23m
P	6.0 x 2.0 x 0.3m

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PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
GABION WEIR:
LEVELS & DETAILS

DATE	JULY 2012
DRAWN BY	D.RAJNA
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-01-206-00/02	A

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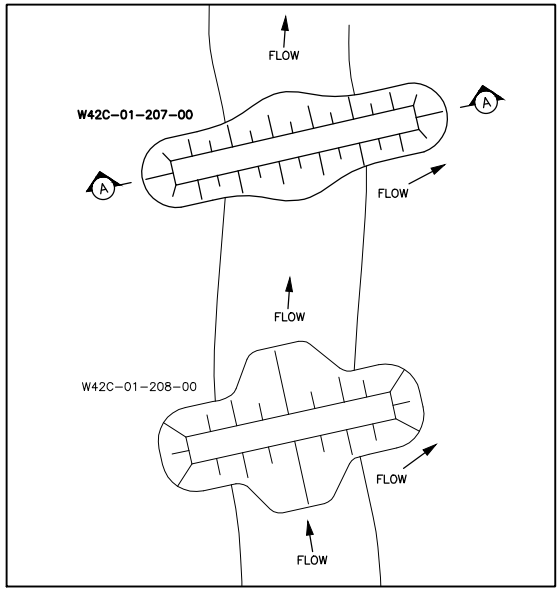
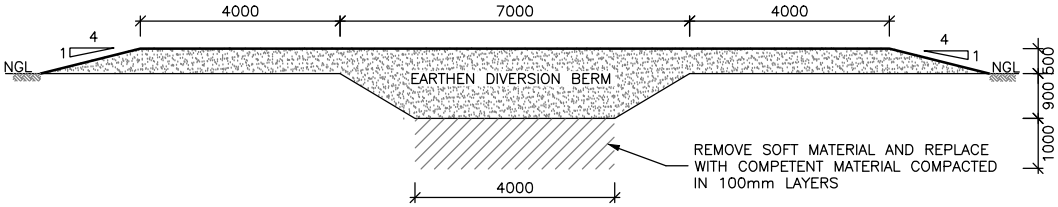
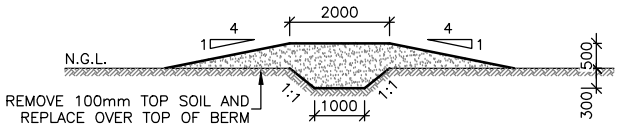


LOCALITY PLAN



SECTION A–A



SECTION B–B

GABIONS:

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NOT FOR CONSTRUCTION. SUBJECT TO EVALUATION OF SITE CONDITIONS BY THE ENGINEER AT SETTING OUT STAGE.

NOTES

1. AURECON ACCEPTS RESPONSIBILITY FOR THE ENGINEERING DESIGN TO THE EXTENT THAT THIS IS BASED ON AVAILABLE INFORMATION. THE AVAILABLE INFORMATION IS LIMITED TO WHAT COULD BE INTERPRETED DURING A SINGLE SITE VISIT OF NO LONGER THAN A FEW HOURS. NO GEOTECHNICAL, TOPOGRAPHICAL, GEOMORPHOLOGIC AND OTHER ENGINEERING RELATED SURVEYS HAVE BEEN UNDERTAKEN TO INFORM THE DESIGN. THIS IS NON–STANDARD ENGINEERING PRACTICE AND THEREFORE AURECON IS INDEMNIFIED BY THE CLIENT AND DOES NOT ACCEPT RESPONSIBILITY FOR THE ASSOCIATED RISK OF FAILURE FROM THE ABOVE LIMITATIONS OR ANY DAMAGES THAT MAY OCCUR.
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Working for Wetlands

aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
GABION DIVERSION WALL

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-01-207-00/01	A

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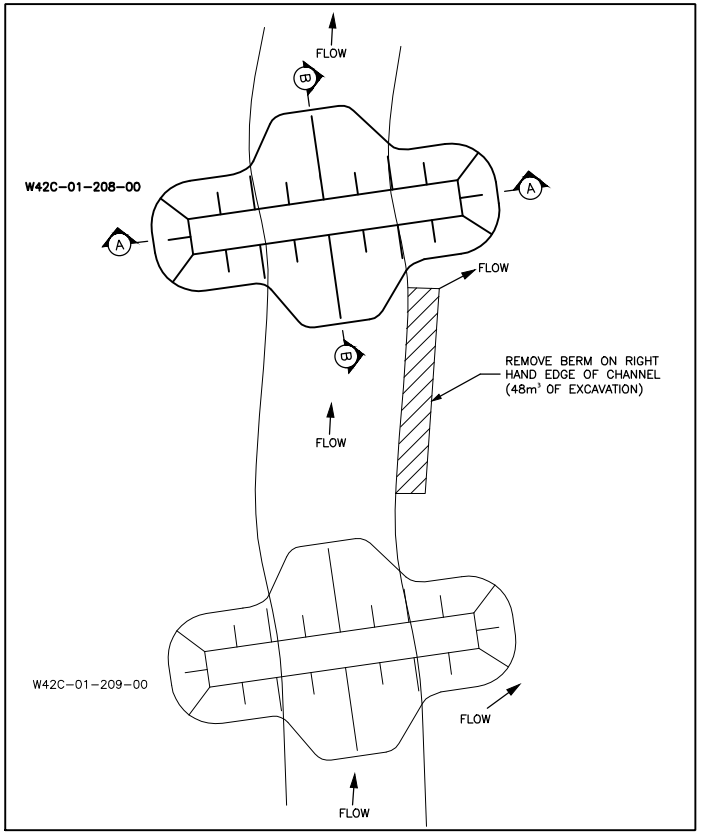
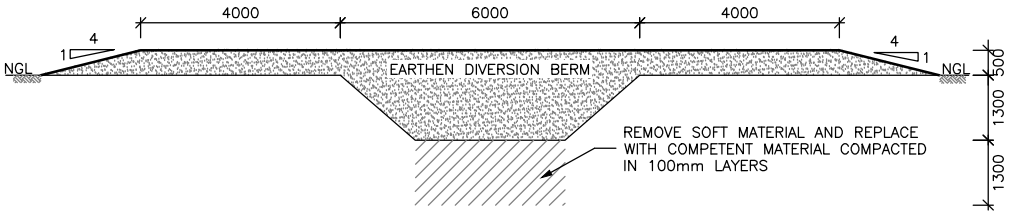
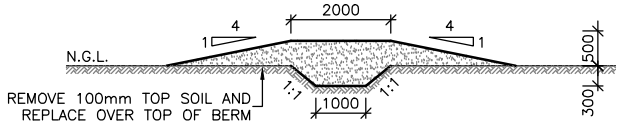


LOCALITY PLAN



SECTION A–A



SECTION B–B

EARTHWORKS:

1. ALL CUT AND FILL SLOPES TO BE NOT STEEPER THAN 1:4, UNLESS OTHERWISE SPECIFIED.
2. ALL EXPOSED DISTURBED SURFACES TO BE REVEGETATED, UNLESS OTHERWISE SPECIFIED.
3. BACKFILL, PARTICULARLY ON BOTH SIDES OF KEYWALLS AND OUTSIDE SIDE WALLS, TO BE COMPACTED IN 100mm LAYERS AT OPTIMUM WATER CONTENT.
4. BACKFILL TO BOTH SIDES OF ALL WALLS TO BE DONE EQUALLY SO THAT ONE SIDE IS NEVER MORE THAN 1m ABOVE THE OTHER SIDE.

DISPERSIVE SOILS:
(ONLY APPLICABLE IN AREAS WITH DISPERSIVE SOILS):

5. IT IS CRITICAL TO ENSURE THAT THE FOUNDING SOIL NEVER DRIES OUT AND REMAINS AS UNDISTURBED AS POSSIBLE. THE BLINDING LAYER SHOULD THEREFORE BE CAST AS SOON AS A PORTION OF EXCAVATION HAS BEEN FINISHED.
6. FILL MATERIAL TO BE GOOD QUALITY, WELL-GRADED GRAVEL OR CLAY (NOT DISPERSIVE CLAY FOUND IN PARTS OF THE FLOOD PLAIN).
7. ALL MATERIAL THAT IS EXCAVATED FROM THIS SITE AND RE-USED FOR BACKFILL SHALL BE WELL MIXED WITH 100kg OF LIME PER CUBIC METRE OF SOIL, AND PLACED AND COMPACTED AT OPTIMUM MOISTURE CONTENT.

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aurecon

PROJECT
WORKING FOR WETLANDS
MPUMALANGA
WAKKERSTROOM

DRAWING DESCRIPTION
EARTHEN DIVERSION BERM

DATE	JULY 2012
DRAWN BY	A.MOHAMED
DRAWING CHECKED	D.TOWNSHEND
DESIGNED BY	T.PIKE
DESIGN CHECKED	
SCALE	NOT TO SCALE

DRAWING No.	REV No.
W42C-01-208-00/01	A

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APPENDIX D – ENVIRONMENTAL AUTHORISATION RECORD OF DECISION

Note: this is a draft document for public comment. The Record of Decision will only be available once the final document has been submitted to the Department of Environmental Affairs and they have made a decision on the application for authorization.

APPENDIX E – LANDOWNER TERMS AND CONDITIONS AGREEMENT

Note: The Landowner Terms and Conditions Agreement will be made available in the Final Rehabilitation Reports.

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PROGRAMME (CEMP) FOR WORKING FOR WETLANDS PROJECTS

September 2010
CEMP Version: 1

***Prepared by*:**
Working for Wetlands programme
Planning, Monitoring and Evaluation Section

DOCUMENT CONTROL

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REVISION AND AMENDMENTS

DATE	NO.	DESCRIPTION OF REVISION OR AMENDMENT

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Context

This Construction Environmental Management Programme (CEMP) has been compiled as a guideline for the mitigation and management measures to be implemented during construction for the proposed wetlands rehabilitation projects in South Africa. **THIS CEMP MUST BE READ IN CONJUNCTION WITH THE FOLLOWING DOCUMENTS:**

- **BASIC CONDITIONS OF EMPLOYMENT ACT, 1997: CODE OF GOOD PRACTICE FOR EMPLOYMENT AND CONDITIONS OF WORK FOR SPECIAL PUBLIC WORKS PROGRAMMES (Annex 1) AND;**
- **BASIC ASSESSMENT REPORT (Annex 2)**

1.2 Background to the request for the CEMP

The Department of Environmental Affairs (DEA) requested the compilation of a CEMP after the evaluation and authorisation of the Basic Assessment Report (BAR) applications for rehabilitation of wetlands in South Africa. The CEMP is based on Impacts Assessments, Public Participation input and Environmental Practitioner's experience.

The purpose of this document is to ensure that all projects implemented under the Working for Wetlands programme adopt an effective and appropriate approach to wetland rehabilitation and that all activities are compliant with relevant legislation. This includes, as top priority, ensuring that the safety of people involved in the projects is not compromised at any time, that rehabilitation interventions are sustainable and that the objectives of the Expanded Public Works Programme (EPWP) and Working for Wetlands are maximised through the projects.

This document forms part of the agreement between the South African National Botanical Institute (SANBI) and each project implementer. This document outlines areas in which compliance is required and serves as a reference against which practices shall be audited. Given that each project operates under specific conditions, innovation by the implementers, and modification of the CEMP, where appropriate, are encouraged within the framework of the prescripts in Section 2.

1.3 Site description

1.3.1 Proposed project and associated construction and operational activities

Refer to the attached Basic Assessment Report appendix A and D

1.3.2 Affected biophysical, economic and social environment

Refer to the attached Basic Assessment Report appendix A and D

1.3.3 Potential Issues Identified during the Impact Assessment in BAR

Refer to the attached Basic Assessment Report appendix A and D

2 PRESCRIPTS

2.1 Expanded public works programme

2.1.1 Compliance with the requirements of the Expanded Public Works Programme

All projects shall comply with:

- The Ministerial Determination on Special Public Works Programmes (Government Notice No. R 63, 25 January 2002)
- The Code of Good Practice for Employment and Conditions of Work for Special Public Works Programmes (Government Notice No. R 64, 25 January 2002)

2.1.2 Employment

The implementer shall not employ any contractor or staff member who has been dismissed from any other project or expanded public works programme. The implementer shall ensure representivity with respect to race and gender in the selection of staff.

2.1.3 Target groups

Projects shall work towards the following targets in all occupational categories, with respect to employment:

- 60 % women
- 20 % youth (18 to 25 years)
- 2% disabled

Where these targets are not immediately realized, a transformation plan shall be put in place to achieve them. The plan will include targets and reasonable timeframes. Progress will be evaluated annually.

2.1.4 Remuneration

All work must be task based. Written approval from the Regional Coordinator is required when this is not possible. Workers are to be paid on the basis of the number of tasks completed.

Employers will pay workers rates provided for in the approved PIP guideline for the current financial year

Contractors shall pay the workers the wage agreed for the task. All production bonuses shall be distributed equitably amongst team members when production targets are achieved.

2.1.5 Employment contracts

Contractors shall have an employment contract with each of their workers. Workers shall have the contents of the contract explained to them, and shall indicate that they understand its contents and the grievance procedure and disciplinary code shall be available to all workers

2.1.6 Management structure

The implementer's management organogram shall be made available to Working for Wetlands upon request.

Project management capacity shall be adequate to deal with the size of project. Each contractor may only have one team.

The implementer and his/her staff shall not have any financial involvement with contractors outside of the formal tender agreements

2.2 Health and safety

2.2.1 Medical examinations

Prior to employment, all employees shall undergo a medical examination performed by a registered occupational health practitioner. Specific job classes shall have annual medical examinations or other tests as specified in the Occupational Health and Safety (OHS) Act.

Records of all medical examinations shall be kept by the implementer.

2.2.2 First aid kit

An adequately equipped first aid kit shall be easily accessible at all work sites. The first aid kit shall be kept fully stocked according to the stock list.

All first aid treatment and usage of stock shall be recorded in the dressing book kept on site.

The first aid kit shall be under control of a trained and competent first aid officer with a current certificate. Each team shall have at least one trained first aid officer and one alternate

2.2.3 Personal protective equipment and clothing (PPE)

The PPE prescribed in the agreement between the implementer and contractor shall be worn at all times during work. PPE shall meet the minimum prescribed standards of quality (SABS approved). PPE shall be replaced when it becomes ineffective through wear and tear.

In order to maintain consistency within the programme, Working for Wetlands shall provide designs to be used on the t-shirts worn by the workers

2.2.4 Occupational health and safety

Each project manager and contractor shall have a copy of the OHS Act. All relevant OHS standards will be fully implemented.

In terms of the OHS Act, the provincial director shall be notified of planned construction work.

The designated health and safety officer shall also be appointed as the construction safety officer. The appointment letter shall be available on site.

Incident reports shall be up to date and available. All incidents shall be reported within 24 hours to the Regional Coordinator. All incidents shall be investigated by a trained incident investigator within 7 days of the incident. All near misses shall be reported to the Regional Coordinator on a quarterly basis.

Health and safety meetings shall be held for all implementers at the quarterly national implementers' forum.

The programme manager, technical advisors and regional coordinators of Working for Wetlands shall intervene to suspend operations at projects where clear violations of health and safety legislation and the best management practices are observed, and where these violations constitute a clear health and safety risk.

2.2.5 Compensation for Injuries and diseases

It is the responsibility of the employers (contractors) to arrange for all persons employed on a Special Public Works Programme (SPWP) to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130 of 1993. The employer (contractor) shall pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer shall be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

2.2.6 Water quality

In wetlands with a high risk of pollution, such as those in urban areas, the project manager shall take steps to ensure that he/she is aware of changes in water quality. If water quality is found to be so poor that it is a threat to health, the following steps shall be taken:

- Workers shall be made aware of it immediately.
- If unable to supply appropriate PPE, work shall stop.
- Workers shall be encouraged not to drink water directly from the wetland.
- Technical Advisors shall be informed of poor water quality.

2.2.7 Water and flooding

Teams working near open water shall have life jackets on site. Consideration shall be given to the safety of team members working near water who are unable to swim.

Given the nature of the work, project managers and contractors shall be sensitive to the potential dangers of floods. A highly risk averse approach shall be followed whenever dealing with an actual or potential flood event. Rainfall in the catchment above the wetland, and flow within the wetland shall continually be visually monitored by project managers and contractors. In high rainfall events where there is an increased risk of sudden floods, workers shall be withdrawn from the site.

2.2.8 Substance abuse

The use of any narcotic substances is not allowed on sites.

The implementer and contractors shall ensure that workers do not perform their duties under the influence of any narcotic or alcoholic substances. Workers who are under the influence during work hours shall be dealt with in terms of the appropriate disciplinary procedures

2.3 Transport

2.3.1 Compliance of vehicles

All vehicles (including trailers) used by projects shall comply with all legal requirements in terms of roadworthiness and licensing and shall display a valid license at all times. The following vehicles shall display a valid Certificate of Fitness:

- Any truck, bus or minibus where the gross vehicle mass exceeds 3500 kg. Any vehicle designed or adapted to convey 12 persons or more, including the driver.
- Vehicles used in transporting persons for reward.

Vehicle size shall be suitable for the number of passengers to be transported. For bakkies, the minimum space required per person translates to the following capacity, including driver and passengers in the front and back:

- Short wheelbase bakkie 0,25m^2 per person standing = 15 persons 0,35m^2 per person seated = 11 persons
- Long wheelbase bakkie 0,25m^2 per person standing = 17 persons 0,35m^2 per person seated = 13 persons.

Minibus taxis shall not carry more than the number of people for which they are certified.

Retreads shall not be fitted to the front wheels of vehicles used for carrying passengers. Wheels on the same axle must be of the same size and be fitted with the same type of tyre.

2.3.2 Daily vehicle checklist

A daily pre-trip vehicle check shall be done and recorded by the driver on a suitable checklist. The checklist shall be up to date and kept in the vehicle. Trailers shall form part of the daily checklist. The project manager shall verify and sign the checklists weekly.

Faults affecting the roadworthiness of the vehicle shall be repaired immediately or alternative transport used.

2.3.3 Driver's licenses and permits

All drivers shall have a valid driver's license for the vehicle category used. The competence of all drivers shall be verified by the implementer. All contractor drivers shall be in possession of a valid appropriate Professional Driving Permit (PDP) for the category of vehicle.

Drivers shall undergo an annual medical check and the results shall be filed with the project manager.

Driver's licenses shall be verified annually by the local traffic authority or by telephoning 012 303 2718.

2.3.4 Passenger safety

Vehicles used for transporting workers shall have suitable passenger facilities, including as a minimum:

- Sufficiently strong railings to a height of 350mm above seat surface or 1000mm above standing surface.
- If installed, benches shall be properly secured
- If installed, canopies or tarpaulins shall be properly secured and ventilated.
- Tools, equipment and containers shall be suitably secured and isolated from passengers.
- Workers and materials, such as rock, cement etc., shall not be transported in the same vehicle at the same time.
- Bakkie-drawn trailers may under no circumstances be used for transporting people.

3 ADMINISTRATION

3.1 Contractor's documents

The contract between the implementer and the contractor shall be readily accessible to project managers and contractors. The project manager must ensure that the contractor and workers understand the contract.

Each contract shall be allocated a unique identity number.

The following shall form part of the contract between the implementer and contractors:

- Rehabilitation specifications
- Technical drawings of the structures, including a list of the material required.
- Environmental management plan
- Site plans

3.2 Records, data and quality control

Each contractor shall maintain an up to date timesheet of daily worker attendance. Details of new appointments shall be submitted to the implementer. Timesheets shall be available for inspection by any Working for Wetlands staff member. A record shall be kept of equipment and consumables issued against the contract document. A quality control sheet completed by the implementer shall record on-going quality checks and the final check before payment. This shall certify that work done complies with contract specifications.

3.3 Payments

The implementer shall ensure that the contractors' workers have been paid on time and in the amount to which they are entitled. Proof of such payment, signed by all team members, shall be submitted to Working for Wetlands on request.

Disabled team members shall be paid the same amount for the days worked as other workers, and the contractor shall claim the half disabled wage back from the implementer.

In situations where tasks are completed before the expected time period, workers shall still be paid for the original number of days quoted. For example, if a team planned to take 15 days to complete a task that is subsequently accomplished in 10 days, the contractor shall still pay the workers for the full 15 days.

Each worker shall receive a payment advice that complies with the requirements of the EPWP documents listed in Section 1. A copy of all contracts and documentation relating to payments to workers shall be retained by the contractor and implementer. This documentation shall provide proof of receipt of payment by workers, and shall be made available to Working for Wetlands on request.

4 GENERAL ENVIRONMENTAL GUIDELINES FOR CONSTRUCTION

4.1 Introduction

As requested by the DEA, this document serves as a guideline for the management of the site by the Environmental Control Officer (ECO). Duties of the ECO shall be carried out by the Provincial Coordinator (PC) via monthly inspections in order to minimise adverse environmental impacts and effects. The PC shall be informed of incidents and accidents on site by the Implementer and His/her staff.

The CEMP provides specifications and regulations that shall in all instances be adhered to. However, it is the responsibility of all people involved to commit themselves to the implementation of the CEMP in all phases of the project or in those instances where specific instructions are provided. The implementer shall be responsible for ensuring compliance of the contractors with the CEMP and shall rely on regular monitoring for compliance. The contractor shall monitor his/her employees to ensure their compliance with the provisions of the CEMP. The contractors shall receive copies of the CEMP from the client at which time he/she will be given the opportunity to resolve any misconceptions and uncertainties. The CEMP shall form part of the contract and will therefore be a legally binding document. In the event of discrepancy with regard to environmental matters or environmental specifications this document shall take precedence.

4.1.1 Environmental Control Officer (ECO)

The contractor shall direct all his/her queries regarding any environmental issues or aspects to the ECO. The ECO shall discuss the matter with the DEA as required and give feedback to the contractor. The ECO shall be responsible for evaluating compliance of all aspects of the CEMP. Monthly site audits shall be undertaken by the ECO and a detailed report submitted to the SANBI for review prior to the following audit. An annual overview report shall be submitted to the DEA. If queries or problems arise for issues that cannot be proficiently addressed by the ECO, the ECO shall seek advice from the Project Manager who shall seek assistance from a person or persons that are educated and experienced in the relevant field.

4.1.2 Feedback to the DEA

Any problems or areas of non-compliance with regard to the CEMP shall be communicated to the Contractor by the ECO, in addition to informing the DEA, who will decide on appropriate action.

4.1.3 Failure to comply with the Environmental Considerations

The ECO shall order the contractor to suspend part or all of the works if the contractor causes damage to the environment by not adhering to the specifications set in the CEMP. The suspension shall be enforced until such time as the offending party/ies' actions, procedure and/or equipment are corrected. No extension of time shall be granted for such delays and all costs shall be borne by the Implementer.

The programme manager, technical advisors and regional coordinators of Working for Wetlands shall intervene to suspend operations at projects where clear violations of the environmental management plan and the best management practices are observed, and where these violations are having or have the potential to cause a significant environmental impact

4.1.4 Environmental training programme

The ECO, with the assistance of the contractor, shall communicate all aspects of the CEMP to the site staff (i.e. from site agents to labourers) prior to commencement of excavation or any other environmentally disturbing activity. Basic environmental awareness training shall be carried out for all employees and shall be included in safety training. A copy of the CEMP shall always be made available on site.

4.1.5 Progress / site meetings

Environmental issues shall be put on the agenda as a discussion point during progress/site meetings. The Implementer, or a designated person involved with environmental issues on the project, shall attend the progress and/or site meetings on a regular basis to provide feedback on any outstanding or contentious environmental matter.

4.2 Public participation

Public participation was undertaken as a component of the BAR. The links to the community that have been established shall be maintained and utilised to the mutual benefit of all parties. The ECO is responsible for addressing any environmental problems or queries that are raised by the community and therefore shall maintain close contact with the representatives of the immediate community. This CEMP shall be made available, on request, for the public to peruse.

5 SITE ESTABLISHMENT

5.1 Site plan

The project manager shall design a site plan for each site that identifies suitable locations for all work, storage, parking, toilet, processing and other areas prior to site establishment. The Contractor shall erect and maintain temporary boundary markers of the type and in the locations directed by the Engineer. Such markers, such as danger tape or suitable equivalent, shall be erected before undertaking designated activities.

5.2 Site clearance

The Contractor shall ensure that the clearance of vegetation is restricted to that required to facilitate the execution of the Works. Site clearance shall occur in a planned manner, and cleared areas shall be stabilised as soon as possible. The detail of vegetation clearing shall be to the Engineer's approval. All cleared vegetation shall either be mulched and mixed into the topsoil stockpiles or disposed of at an approved disposal site. The disposal of vegetation by burying or burning is prohibited without the requisite permit from the local authority.

The Contractor shall strip the Top-material within the working areas. The Top-material shall be stockpiled separately from subsoil and used for subsequent rehabilitation and revegetation. Top-material stockpiles shall not be compacted.

Should fauna be encountered during site clearance, earthworks shall cease until fauna have been safely relocated.

5.3 "No-go" areas

The construction site shall be contained in an area required to undertake the works. Any area beyond shall be considered "no go" areas. The Contractor shall ensure that, insofar as she/he has the authority, no unauthorised

entry, stockpiling, dumping or storage of equipment or materials shall be allowed within the demarcated “no go” areas.

“No go” areas shall be clearly demarcated with commercially available danger tape or suitable equivalent. The Contractor shall maintain the construction site boundary for the duration of construction and ensure that the danger tape does not become dislodged.

5.4 Waste currently on site

The site shall be cleared of all litter/waste prior to any construction related activities and the waste shall be disposed of at a registered waste disposal facility. This is to ensure that no waste is incorporated into the environment during the construction process. Recycling of waste material shall be encouraged.

5.5 Vegetation clearing

Vegetation on the site shall be removed prior to commencement of construction activities. However, care shall be taken to confine removal of vegetation during construction activities to within the boundaries of the development area. The removal, damage or disturbance of any flora and fauna outside the construction area shall not be permitted unless specifically authorised by the ECO.

No areas may remain cleared (bare soil exposed) for longer than 3 weeks. Efficient construction planning must ensure that all relevant materials, construction equipment and manpower are available upon commencement of construction in an area. Thereafter, the cleared areas must be suitably re-vegetated (refer to Section 12).

5.6 Biodiversity

Disturbance of indigenous plants and animals shall be minimised. Collection of indigenous plants, parts of plants or animals may only take place with the appropriate permits.

Level 2 and 3 structures shall take into consideration the migration of fish species.

Bio-engineering methods that involve re-vegetation will, as far as possible, use individuals of local species taken from surrounding areas, in order to avoid or reduce genetic pollution. Collection must not lead to habitat destruction. Alien species may not be used for re-vegetation unless approved by the Provincial Coordinator.

5.7 Removal of top-material

Prior to the commencement of construction activities top-material (up to a maximum of 30 cm) shall be removed from the work area and stockpiled for re-use in subsequent rehabilitation and landscaping activities. The top-material shall be stockpiled separately from the subsoil and construction materials. The contractor shall ensure that no remnants of stockpiles are left in positions or states that may be eroded during and after construction.

5.8 Defacement of natural features

Trees, natural vegetation, or any other natural features outside the work area, which will not be cleared for construction purposes, shall not be defaced or painted for benchmarks. No damage is permissible, not even for survey purposes. The latter shall only be undertaken if agreed to by the ECO. Any feature defaced by the contractor shall be reinstated to the satisfaction of the ECO.

Should any Red Data species be encountered, *in situ* conservation shall be undertaken if at all possible. Should this not be considered possible then a specialist shall be consulted for possible relocation.

In addition, any bird nests encountered should not be interfered with. If impact is unavoidable the nest shall be relocated by a suitably qualified individual.

No pesticides of any description shall be used during the construction phase. Pesticides should also be discouraged from use during the operational phase of the project.

For the conservation of wildlife, should any be found, species may not be killed or otherwise deliberately disturbed. It is anticipated that as a result of the construction wildlife species will take shelter in neighbouring areas and reserves. Although highly unlikely, construction workers should be advised not to catch or kill any wild animals in the area, including snakes.

5.9 Heritage sites and features

No archaeological or heritage sites have been identified on site. If archaeological or heritage sites are exposed during construction work all activities shall be halted and the incident shall immediately be reported the appropriate provincial heritage authority[1] for investigation and evaluation of the find. Old burial grounds (if found) will be reported to the ECO who will advise the contractor as to the mode of action, which will include informing the South African Police Service (SAPS) and the South African Heritage Resources Agency (SAHRA).

5.10 Stabilizing of steep slopes

The disturbance of steep slopes, for example by the removal of vegetation, may result in slope instability and erosion by rain and surface runoff. All slopes that are disturbed during construction shall immediately be stabilised to prevent erosion. The rehabilitation measures listed in Section 12 must be implemented in the rehabilitation.

5.11 Removal of alien vegetation

The contractor shall ensure that invasive alien vegetation is cleared from the entire site prior to the commencement of construction activities. Any species that are declared invasive species [according to the Conservation of Agricultural Resources Act (Act 43 of 1983)] must be removed from site. Follow up clearing may be necessary if the species re-establish following the initial clearing. No trees within environmentally sensitive areas may be removed, whether alien species or not, unless permitted by the ECO.

Other alien species (non-listed) occurring on site shall not be used for landscaping activities and shall be removed from site where possible.

5.12 Revegetation

Once construction is complete, rehabilitation (i.e. the planting of indigenous vegetation) of disturbed areas shall be undertaken immediately in order to restore the aesthetic and ecological value of the area. Only locally appropriate indigenous vegetation shall be utilised. Rehabilitation shall be undertaken according to the following schedule:

- Infilling of all excavation work. Subsoil shall be filled in first to ensure that topsoil is present on the surface to secure a suitable plant growth medium. Substrate that is not suitable for plant growth should not be used for infilling of excavations unless it is used at a suitable depth e.g. deeper than 2 m.
- Removal of all construction rubble from the site, including substances that cannot be used for infilling of excavations, shall be undertaken.

[1] If no provincial heritage authority in place then the South African Heritage Resources Agency (SAHRA) shall be contacted.

- Steep and unstable slopes shall have stabilising measures put in place to prevent collapse of the slopes or soil erosion. Slope stabilisation and soil erosion prevention measures include the placement of silt fences, staked grass sods and rows of sawdust filled onion bags.
- The exposed ground should be seeded and mulched with an appropriate stabilising grass mixture. A good stabilising grass seed mix should include:
    - *Andropogon eucomus* (Snowflake Grass)
    - *Aristida congesta* (Tassel Three-awn)
    - *Cenchrus ciliaris* (Foxtail Buffalo Grass)
    - *Cynodon dactylon* (Kweek/Couch grass)
    - *Digitaria eriantha* (Common Finger Grass)
    - *Eragrostis curvula* (Weeping Love Grass)
    - *Imperata cylindrical* (Cottonwool Grass)
    - *Melinis repens* (Natal Red Top)

The site shall be watered following seeding and mulching, and continued on a regular basis, the frequency depending on the amount of rainfall received. Should germination not occur within one month of planting, the site should be reseeded and mulched.

6 ENVIRONMENTAL PLANNING

The implementation of wetland rehabilitation activities has potential impacts on the wetland site and the downstream habitat. The implementation of these activities shall take into consideration the following potential impacts.

6.1 Hydrological impacts

The construction of interventions within watercourses is likely to have difficulties associated with the presence of water, under both normal and wet conditions. In the event that the planned interventions are located within the seasonal and permanent zones of the wetland, diversions may need to be put in place to temporarily divert water away from the work site.

In order to reduce the requirements to divert water from the construction site, implementation of the rehabilitation activities within seasonal and permanent wetness zones shall take place within the dry season:

- Winter rainfall areas - November to March
- Summer rainfall areas - May to September

In those cases where working in wet conditions is unavoidable the following shall be implemented:

- Water shall be diverted away from the intervention site during the implementation of rehabilitation activities
- Diversions shall be temporary in nature (e.g. sand bags, eco-logs)
- Upon completion of the rehabilitation activities at the site, the diversions shall be removed to restore natural flow patterns
- In those instances where the impact of the diversions are negligible and removal may result in further disturbance, diversions structures shall be left *in situ* (this shall be decided in consultation with Working for Wetlands)

Water courses are subject to unanticipated flooding and adequate precautions shall be taken to avoid damage to facilities, equipment and wetland habitat:

- Ensure storage areas are located outside of floodable areas
- Minimise the extent of disturbed/exposed areas to reduce extensive damage during flood events

6.2 Disturbances

6.2.1 Vegetation

Disturbance of indigenous plants within the wetland and surrounding catchment shall be minimised. In the event that vegetation needs to be removed during construction, the vegetation shall be stored in a shaded and moist area, or at the Peninsula project's nursery site, for use in revegetation. Re-vegetation of all exposed soil must be done before the team leaves the site.

Bio-engineering methods involving the re-vegetation or planting of specified areas shall, as far as possible, use local plant species obtained from the following sources:

- vegetation removed during excavation,
- local 'borrow' sites, or
- naturally sourced seed mixes

This should limit the threat of introducing genetically-modified and genetically different species into the area. Non-invasive alien plant species shall not be used for re-vegetation unless approved by the Working for Wetlands (e.g. Vetiver grass)

The collection of indigenous plant or parts thereof shall only take place if the following guidelines are followed:

- Obtain the required collection permits
- Limit habitat destruction
- Implement 'mosaic' collection to ensure limited disturbance and adequate recovery of the 'borrow' site.

6.2.2 Faunal species

Disturbance of faunal species within the wetland and surrounding catchment shall be minimised. This includes minimising:

- disruptions to the movements/migration of species;
- interruptions of breeding activities and behaviour;
- disturbance of feeding and breeding sites.

The presence of species of conservation importance shall be known prior to the commencement of rehabilitation activities. In those instances where these species are present, work shall be scheduled to reduce the impacts on the abovementioned activities. This information shall be determined by means of consultation with specialists.

The construction of interventions within wetlands and watercourses necessitates the planning of these interventions taking into consideration the migration of fish species where applicable.

6.2.3 Local resources

In some instances locally available resources may be utilised in the implementation of wetland rehabilitation activities. This would primarily be rocks for the construction of gabion structures. Prior approval of the technical advisor shall be obtained, with respect to:

- suitable rock types,
- suitable areas for collection, and
- appropriate collection methods

All purchased rock shall be from registered and approved crushers. Copies of the certificates shall be kept on file by the implementer. Any rock that is collected from old quarries or mine dumps shall have the necessary documentation from the land owner.

6.3 Compaction

The storage of materials and access to the site is likely to result in the compaction of the soil around the site. This increases the risk of erosion and sediment generation originating from the site.

All impacted areas shall be rehabilitated (loosen soil and re-vegetate) once work has been completed and prior to the team leaving the site. These activities shall include the closure and rehabilitation of temporary access routes and addressing any potential erosion risks.

6.4 Sediment mobilisation

The construction of interventions within watercourses is likely to have impacts on downstream habitat associated with the presence of sediment within runoff water. In order to reduce impacts associated with sediment from the construction site, implementation of the rehabilitation activities should take place within the dry season:

- Winter rainfall areas - November to March
- Summer rainfall areas - May to September

In those instances where the toes of structures are designed to be flooded by the downstream structures work shall commence from the top of the system down. This shall ensure that work occurs in drier conditions and less sediment would be mobilised during excavation. The impacts associated with sediment generated during earthworks shall be minimised by constructing temporary sediment traps downstream, preferably at the location of the next intervention, to reduce disturbance footprints.

In those instances where structures are not designed to be flooded by downstream structures, the interventions shall be constructed from the bottom of the system up, so that each structure then serves as a sediment trap for the construction upstream.

Further measures to reduce sediment generated from construction activities include ensuring that soil is not deposited into a watercourse and the re-vegetation of the exposed areas as soon as possible as per Section 10.2.

7 CONSTRUCTION SITE

7.1 Restriction to working area

It is important that activities are conducted within a limited area so as to facilitate control and to minimise the impact on the existing natural environment and disturbance to the neighbouring communities. Working areas are defined as those areas required by the contractor to undertake the works as agreed with the ECO.

7.2 Contractor's camp

An area to be approved by the ECO shall be taped off for the purpose of temporary staff accommodation facilities during the construction period. . The contractor's camp, offices and storage facilities shall be located within the site boundaries. No person shall be allowed to stay on the neighbouring site. Any temporary structures erected during construction will be restricted to the construction campsite. The taped area shall include that of a 10 m buffer zone between the site and the 1:100 year floodline of any watercourse and/or dam.

All staff remaining on site shall be supplied (by the contractor) with adequate protective clothing, water and refuse facilities (with regular collection) and facilities for cooking and heating. No open fires shall be permitted.

The contractor shall provide water and/or washing facilities at the construction camp for the site staff.

All contractor vehicles shall be stored in a location where an oil trap shall be installed to prevent soil pollution. The ECO shall advise the contractor on a suitable area on the site.

7.3 Stores and workshops

Stores buildings and containers shall be secure and provide safe storage space where equipment and materials will not deteriorate.

All stores and workshops shall comply with the OHS Act and shall show a high standard of housekeeping.

7.4 Refuse

Refuse refers to all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste etc. The contractor shall be responsible for the establishment of a refuse control and removal system that prevents the spread of refuse within and beyond the construction site.

The contractor shall ensure that all refuse is disposed of by him/her and his/her sub-contractors' employees in refuse bins which he/she shall supply and arrange to be emptied on a daily basis. These bins shall all have lids and shall be adequate in number and accessibility.

Waste shall be separated as follows:

- Hazardous waste, consisting of substances that may be harmful to the receiving environment, and therefore require precautionary measures when handled. Examples include (but not limited to) oil, paint, diesel etc., (in addition, refer to Section 7.7 and 10.8).

- General waste, consisting of non-hazardous substances and substances that cannot be recycled. Examples include (but not limited to) construction rubble, excess construction materials that cannot be reused, and food waste.
- Reusable construction material, which can be used at other construction sites.
- Where possible, glass and metal waste should be separated and removed from site for recycling purposes

Refuse bins shall be watertight, wind-proof and scavenger proof and shall be appropriately placed throughout the site and shall also be conspicuous (e.g. painted bright yellow). Refuse shall also be protected from rain, which may cause pollutants to leach out. Particular caution shall be exercised with regards to handling of hazardous waste, to ensure that it does not spill or leak from the waste collection containers. The utmost care shall be taken to ensure that no waste is able to enter wetlands and/or dams on or near to the site.

The contractor or the appointed Waste Removal Company shall truck refuse collected out of the construction site. Refuse shall be disposed of at a Department of Water Affairs (DWA) registered site on a needs-scheduled basis. The disposal site shall also be approved of by the contractor and the local authority. Refuse shall not be burned or buried on or near the site.

The contractor shall ensure that the contractor's camp and construction site is cleaned on a daily basis. These areas shall then be inspected by the contractor to ensure compliance with this requirement. A litter patrol around the construction area shall take place twice weekly to ensure that all litter is cleared up.

The contractor shall be warned, in writing, by the ECO of any infringement and shall be expected to clear the litter within 24 hours of the notification.

The contractor shall be responsible for cleaning the contractor's camp and construction site of all structures, equipment, residual litter and building materials at the end of the contract and where necessary and appropriate, the ground scarified, topsoil restored and indigenous vegetation re-established.

The contractor will be responsible for removal of rubbish, which may wash into watercourses as a result of litter. The contractor will also be responsible for any litter in the sensitive areas, which is dumped or left there by the construction crew.

7.5 Ablution facilities

The contractor shall be responsible for provision of sanitation for his/her and the sub-contractor's staff. Where possible, a minimum of one pit latrine shall be provided per 15 persons. Toilets may not be situated within 50 metres of a watercourse. Should toilets be needed elsewhere, their location shall first be approved by the ECO. The ECO is responsible for ensuring that any toilets placed are suitably situated and comply with requirements stated below.

The toilets shall be provided with doors and locks and shall be secured to prevent them from falling over. Toilets shall be placed outside areas susceptible to potential flooding. The contractor shall supply toilet paper at all toilets at all times. The contractor shall ensure that the labourers make use of the toilets provided.

The contractor shall be responsible for the cleaning, maintenance and servicing of the toilets. The contractor shall ensure that the toilets are protected from vandals. No litter or general waste shall be placed in the toilets.

Upon completion of the contract the pit latrines shall be filled in and all structures shall be removed from site.

Washing areas with soap and sufficient clean water shall be provided for hand washing after ablutions. .

7.6 Eating areas

The contractor shall, in conjunction with the ECO, designate restricted areas for eating. The contractor shall provide adequate refuse bins that must be cleaned on a daily basis.

The feeding, or leaving of food, for stray or other animals in the area is strictly prohibited.

7.7 Fuel and chemical management

The contractor shall ensure that fuels and chemicals (e.g. drums of fuel, grease, oil, brake fluid, hydraulic fluid) are stored and handled carefully so as to prevent spillage. In the event of a spill, appropriate steps shall be undertaken to prevent widespread pollution. These liquids shall be confined to specific and secured areas within the contractor's camp and shall be clearly marked. The liquids shall be stored in a bunded area with adequate containment (at least 1.5 times the volume of the fuel) with an impermeable floor beneath them for potential spills or leaks, in such a way that does not pose any danger of pollution even during times of high rainfall.

In addition, the contractor shall ensure that workers do not smoke or take part in any activity that may result in sparks in the vicinity of fuels and other flammable substances to prevent ignition.

Refuelling of vehicles shall only take place at a predetermined area, where adequate pollution prevention measures are in place to such as a smooth impermeable floor (concrete or 250 µm plastic covered in sand). Appropriate signage shall be erected indicating the refuelling and storage areas. Mixing of lubricants will be on the non-pervious layer at least 20m from the wetland edge.

A specialist waste contractor shall dispose of any hazardous waste off-site at a licensed hazardous waste disposal site.

The contractor shall be responsible for ensuring that any party delivering potentially dangerous chemicals and oil to site is aware of the appropriate storage and drop-off locations and procedures. Transfer of hazardous chemicals and other potentially hazardous substances shall be carried out so as to minimise the potential leakage and prevent spillage onto the soil.

7.7.1 Equipment

Drip trays shall be put in place in relevant locations (inlets, outlets, points of leakage, etc.) so as to prevent spillage or leakage during transfer. The contractor shall stand any equipment that may leak, and does not have to be transported regularly on watertight drip trays to catch any pollutants. The drip trays shall be of a size that the equipment can be placed inside it. Drip trays shall be cleaned regularly and shall not be allowed to overflow. Substances, which cannot be reused, shall be disposed of according to the relevant waste disposal procedure. The ECO shall inform and advise the contractor as to the best waste disposal procedure.

If fuel is dispensed from 200 litre drums, only empty externally clean drums may be stored on the bare ground. All empty externally dirty drums shall be stored on an area where the ground has been protected. The proper dispensing equipment shall be used, and the drum shall not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage drum shall be stored in a waterproof container when not in use.

7.7.2 Spill procedure

The contractor shall keep the necessary materials and equipment on site to deal with spillage of the relevant hazardous substances present on site. The contractor shall set up a procedure for dealing with spills, which will include notifying the ECO and the relevant authorities immediately following the spillage event. These procedures must be developed with consultation and approval by the appointed ECO.

The clean up of spills caused as a result of the construction activities, and any damage to the environment, shall be for the contractor's own account. A record must be kept of all spills and the corrective action taken.

7.8 Vehicles

Site vehicles shall only permitted within the demarcated construction camp, as required, to complete their specific task.

All construction vehicles shall be in a good working order to reduce possible noise pollution. Local and Provincial Noise Regulations shall be complied with at all times.

On-site vehicles shall be limited to approved access routes and areas (including turning circles and parking) on the site so as to minimise excessive environmental disturbance to the soil and vegetation on site. Servicing and maintenance of vehicles on-site shall be avoided as far as possible.

Construction shall be limited to normal working hours (as described in Section 10.1), in order to limit disturbance from vehicles and construction activity.

7.9 Hand tools

Hand tools will be suited to the nature of the work. Tools will have correct, properly secured handles and will be in safe working order. Tools will be properly maintained and sharpened regularly. Tools will be used in the correct and safe manner.

7.10 Concrete mixers, compactors and other machinery

All machinery will have the required machine guards. All nip points, pulleys, fan belts and revolving parts will be suitably enclosed. Power take offs will be provided with suitable covers in good condition. Covers will be chained to non-revolving machinery.

Only trained operators may operate machinery, and will wear the required PPE. Workers, other than machine operators, will not be within two spade lengths of operating machinery

Concrete mixers may only operate on a stable, level site.

Machinery will be in good working order. If owned by the implementer or contractor there will be a maintenance schedule and record for the machinery. Machinery will be used safely and efficiently at all times.

7.11 Stockpiling of materials

The contractor shall temporarily stockpile excavated materials (e.g. soils and rocks) and construction materials in such a way that the spread of materials is minimised. The stockpiles may only be placed within the demarcated stockpile area, which must fall within the demarcated construction area. The contractor shall, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. Stockpiles of construction materials must be clearly separated from topsoil stockpiles in order to limit any contamination of the topsoil. Stockpiles shall be located away from sensitive hydrological features (including but not limited to dams, wetlands, watercourses, ponds, pans, drainage channels, etc.). Stockpiles shall be less than 2 metres in height.

Storm water runoff from the stockpile sites and surrounding areas shall be directed into the storm water system and shall not run freely into the surrounding environment, or create "ponding" or accumulation of water.

Stockpiles shall be stabilised if signs of erosion are visible. Erosion control measures such as silt fences must be placed around the stockpiles.

7.12 Stock control

The receipt and issue of all equipment and supplies will be adequately controlled. All issues and receipts will be recorded. The balance of stock recorded will correspond at all times with stock in the stores. Designated managers will verify stock periodically and on a bi-annual basis, stocktaking will be done. The proper procedures will be followed in disposing of unserviceable or surplus items.

Where contractors cannot make use of proper dedicated stores, all equipment and supplies will be safely and securely stored with controlled access.

7.13 Temporary fencing

The contractor shall ensure that the construction camp is demarcated with danger tape, or suitable equivalent, for the duration of the construction period.

The tape shall serve to prevent public access to the camp, for public safety and security reasons. Tape shall be placed around the sensitive hydrological features buffer no-go areas on site.

The contractor must maintain the tape for the duration of the construction period. All tape must be removed and the site restored on completion of the project.

8 METHOD OF WORK

8.1 Verification of work

Actual work done (volumes and areas) shall be verified and recorded by the implementer, who is responsible for ensuring that contractors' invoices correspond to actual production. The implementer shall verify a minimum of 5% of work completed during the month. On completion of an intervention, a certificate of completion shall be submitted to the regional coordinator by the implementer.

8.2 Corrective action for sub-standard work

Payment shall not be made for work that does not comply with contract specifications. A record shall be kept of non-compliance to standards and poor performance. Copies of instructions issued to contractors to correct deficiencies shall be kept.

8.3 Minimum standards for construction

8.3.1 Gabions

Gabion work shall be done according to design specifications.

Minimum 2.5mm double galvanised wire shall be used, with a mesh size that is appropriate to the size of the rock being used. Support and binding wire shall be a minimum 2.2 mm. Lacing will be done according to specification. Support wires shall be in place (bracing). All adjoining baskets shall be laced together. Geotextile shall line all faces of the gab ion baskets that are exposed to earth and certain water exposed sides.

Water corrosivity shall be determined at each site; if necessary PVC coated gabions shall be used.

Soil dispersivity shall be determined at each site. If dispersive soils are detected, the technical advisor shall be contacted.

Density of fill material shall satisfy the gabion design. Clay bricks, weathered rock and sandstone and shale shall not be used as fill material. Any unconventional fill material shall be approved by the technical advisor. Fill material shall not be smaller than mesh size. Where fill material is hauled to its point of placement by means of wheelbarrows, the haul distance shall not be greater than 150m.

Workers shall be trained in gabion construction by an accredited organisation.

8.3.2 Cement and concrete batching

Concrete mix shall be according to specifications and correct MP A concrete must be used. Manufacturer's directions for mixing, consistency and treatment after pouring will be complied with.

Cement shall be stored in dry conditions for no longer than six weeks after delivery. When cement is stored temporarily infield it shall be kept on a dry waterproof base with a waterproof cover.

A demarcated site at least 20m away from water/wetland edge shall be used for cement mixing. No batching activities shall occur directly on unprotected ground. The batching plant shall be located on a smooth impermeable surface (concrete or 250 µm plastic covered with 5 cm of sand). The area shall be bunded and sloped towards a sump to contain spillages of substances. All wastewater resulting from batching of concrete shall be disposed of via a contaminated water management system and shall not be discharged into the

environment. Contaminated water storage areas shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented

Empty cement bags shall be stored in weather proof containers to prevent windblown cement dust and water contamination. Empty cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose. Unused cement bags shall be stored so as not to be affected by rain or runoff events. In this regard, closed steel containers shall be used for the storage of cement powder and any additives. The Contractor shall ensure that sand, aggregate, cement or additives used during the mixing process are contained and covered to prevent contamination of the surrounding environment.

The Contractor shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the cement/ concrete pour and appropriately disposed of. All spoiled and excess aggregate/ cement/ concrete shall be removed and disposed of via the solid waste management system.

Construction using shuttering shall not take place at more than 1m height increments. Reinforcing shall be used according to specification. Concrete will be mixed and used on the same day. Where sand, stone and cement are hauled to their point of placement by means of wheel barrows; the haul distance may not be greater than 150m.

Where applicable, the location of the batching plant (including the location of cement stores, sand and aggregate stockpiles) shall be as approved by the Engineer. The concrete/cement batching plant shall be kept neat and clean at all times.

8.3.3 Geo cells

Geo cells shall not be used in conditions that exceed their design specifications. Geo cell material shall be UV resistant. Geo cells shall be anchored in by the "trench" method and in such a way that prevents undermining of the cells. Fill material shall conform to the design specifications. The following general rules shall be applied:

- If soil is used to fill the cells, it shall be re-vegetated immediately,
- If concrete is used to fill the cells, some degree of permeability of the structure shall be permitted. If concrete is used as fill, concrete baffles shall be inserted. Rock is not suitable for this purpose.

8.3.4 Earth works

Excavations may not exceed 1.5m depth without shoring and reinforcement. Excavation and compaction must comply with design specifications. The technical advisor must be consulted for work undertaken in dispersive, unstable and organic soils. Backfilling in trenches must be done in layers of thickness not exceeding 100mm before compaction. Each layer shall be compacted using hand compactors. Where excavation material is hauled by means of wheelbarrows, the haul distance may not be greater than 150m.

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities, particularly with regards to erosion and dust generation. No equipment associated with earthworks shall be allowed outside of the Site and defined access routes unless expressly permitted by the Engineer.

9 TRAINING

9.1 Training entitlement

In compliance with EPWP requirements, each worker shall be entitled to a minimum of two days training for every 22 days worked.

All training funded through the Department of Labour shall be planned in conjunction with the department's provincial representatives. A minimum of 30% of all training shall be accredited, and all first aid and health and safety training shall be accredited.

9.2 Wetland awareness

All project personnel shall be trained in basic wetland awareness, including a basic understanding of the components of wetlands, how wetlands function, the benefits they provide, why they need to be conserved and used sustainably, and the importance of rehabilitation in contributing to wetland conservation and sustainable use. Training shall take place as a minimum once a month.

9.3 Wildlife

Where work takes place in areas containing dangerous game, especially nature reserves and national parks, workers shall receive training in basic animal behaviour. In these areas, before work commences each day, the site shall be checked for dangerous animals.

A person trained in dangerous animal behaviour shall be present and suitably equipped to deal with such threats at all times. Wherever possible, first aid training shall include treatments for snakebites.

9.4 Environmental induction training

Within seven days of the commencement date, the Contractor's site staff including foremen and site management staff shall attend an environmental awareness training course, of approximately one-hour duration. The Contractor shall liaise with the Engineer prior to the Commencement Date to fix a date and venue for the course. The Contractor shall provide a suitable venue with facilities and ensure that the specified employees attend the course.

No more than 20 people shall attend each course and the Contractor shall allow for sufficient sessions to train all personnel. Subsequent sessions shall be run for any new personnel coming onto site.

The environmental awareness training course shall be held in the morning during normal working hours. Any new employees coming on to site after the initial training course and the Contractor’s suppliers and subcontractors shall also attend the course. Provision should also be made for quarterly refreshers courses to be undertaken during the course of the Contract. The Contractor shall ensure that all attendees sign an attendance register, and shall provide the Engineer with a copy of the attendance register the day after each course.

9.5 Health and safety training

The following minimum levels of training are required with respect to health and safety:

- All workers and contractors must successfully complete phase 1 health and safety training.
- All project managers must successfully complete phase 2 health and safety training.

9.6 First aid training

Two first aid officers will be trained per team.

9.7 Training records

Training attendance records shall be kept by the implementer. The implementer will be responsible for obtaining all contractor and worker training information.

9.8 Fire fighting training

All workers shall receive basic fire fighting training in areas where this is appropriate

10 ENVIRONMENTAL CONTROL MEASURES

10.1 Control of working hours

Working hours for all operations shall be limited to between 08h00 and 17h00 on weekdays. No work shall take place on a Saturday, Sunday and or Public Holidays. Any deviations to these work hours shall be cleared with the ECO prior to implementation.

10.2 Control of runoff that could cause pollution

Pollution may result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage, wastewater containing organic kitchen waste, detergents, solid waste, litter and other such substances. The contractor shall ensure that rainwater does not run into areas containing cement, oil, diesel and other such substances as this could result in a pollution threat to sensitive environmental areas. Storage areas for these substances shall be placed on high lying ground and contain a bunded area in case of a spill. The bunded area shall be covered if deemed appropriate by the ECO.

Berms must be constructed to direct all runoff into the storm water system. The engineers shall prepare temporary storm water channels for unexpected rains during construction. Erosion control measures shall be placed in areas where runoff concentrates in order to detain the sediment load and slow down the runoff. Erosion controls shall be put in place on all drainage channels that drain into water resources. These measures shall include, but not be limited to, silt fences, brushwood and rows of sawdust-filled onion bags. No wastewater shall run freely into any of the surrounding environment. Runoff containing high sediment loads shall not to be released directly into natural or municipal drainage systems or nearby water resources. Should sediment occur in runoff, an attenuation pond shall be constructed to allow solids to settle out prior to leaving the site.

Runoff from the site itself shall be free from oil, waste and litter before joining the storm water system or streams. This shall be ensured by securing any hazardous substances containers in order to prevent runoff and by cleaning up any refuse and construction material from the site on a regular basis.

Litter management in the storm water system or channels that lead to streams and or wetland shall be implemented. It is outside the scope of this document to prescribe litter trap designs, but the important aspect is that it shall be incorporated into the design of the development. Litter traps shall prevent solid waste from entering the storm water system.

The contractor shall only be allowed to draw water from the source/s designated by the client and the ECO. The client shall ensure that the contractor is aware of the designated water sources, and the ECO shall ensure that this is adhered to. Personnel shall not use natural hydrological features for any purpose, including recreation. These areas shall be considered “no-go” areas.

In the event of any pollution entering an environmentally sensitive area and/or buffer zone as a result of the contractor’s actions, the contractor shall be responsible for all costs incurred to assist in pollution control and/or to clean up the polluted area. Damage to the wetland as a result of the project operations shall be for the contractor’s account. The responsibility of the remediation of the pollution/erosion event will ultimately lie with the contractor.

10.3 Pollution control

The contractor/s shall ensure that pollution of surface and/or groundwater does not occur as a result of site activities.

In the event of pollution caused as a result of construction activities, the contractor, according to Section 20 of the National Water Act (Act No. 36 of 1998), shall be responsible for all costs incurred by organisations called to assist in pollution control and/or to clean up polluted areas. The public shall not call upon any organisation to assist with clean-up activities before the matter has been discussed with the contractor. The ECO shall be notified immediately following any pollution event.

The ECO shall ensure that the contractors are aware that shallow groundwater is susceptible to contamination from spills. Therefore good management practices (in accordance with local bylaws) are required to reduce the impact of the waste generation potential.

Builders' rubble and other debris shall be confined to the building site and shall not be stored/discarded on any open space outside the development area. The status of the hydrological features on or near to the site shall be monitored by the ECO to ensure that pollution does not occur in these areas.

10.4 Erosion control

The contractor shall take reasonable measures (to the satisfaction of the ECO) to prevent erosion caused by work, operations and activities undertaken during excavation and construction activities. The contractor shall ensure that disturbance on steep slopes is kept to a minimum, thus reducing the potential for erosion. The contractor is responsible for rehabilitating all disturbed areas in such a way that no future erosion will occur.

Erosion may occur in the event of rain during the excavation and construction period. Any erosion that occurs during a heavy rainfall event shall be remediated at the expense of the project budget. This shall include clean-up of the silt deposited and filling up of erosion channels that may form. Construction in sensitive areas shall be undertaken during the dry season if possible.

10.5 Dust control

The contractor shall take into consideration that there may be residential areas surrounding the building site and that dust could be a major disturbance, especially during the dry season.

The contractor shall take appropriate and reasonable measures to minimise the generation of dust as a result of his/her works, operations and activities. Particular attention shall be given to preventing dust generation during excavation and stockpiling activities. The contractor shall be responsible for educating the employees to report any excessively dusty conditions to the contractor, the ECO or responsible representative.

Corrective and preventative measures shall include (but not be limited to) regular and effective treatment of working areas using water sprays and appropriate scheduling of dust-generating activities.

The contractor shall ensure that transported materials do not escape from the construction vehicles by providing adequate covering for all load beds.

10.6 Noise control

Probably the two most important concepts in the regulation of noise are those of *disturbing noise* and *noise nuisance*.

A disturbing noise is one that exceeds the zone sound level set by the local authority. A noise nuisance means any sound, which disturbs or impairs or may disturb or impair the convenience or peace of persons.

Some of the activities that could constitute a noise nuisance are power tools, driving, loading and hooters. All of these elements could be connected with building activities.

Each province has its own noise regulations such as Gauteng Province promulgated new noise regulations in 1999 published in Provincial Notice 5479 of 1999 (Gauteng Noise Regulations). The contractor shall obtain and familiarise him/her with these regulations and ensure that he/she abides by these regulations at all times. The contractor shall familiarise him/herself with, and adhere to, any by-laws and regulations regarding the control of noise in their municipal areas.

Every effort shall be made to limit exceedingly noisy activities. Construction vehicles shall be in good working order such that they do not create a noise nuisance. Appropriate directional and intensity settings shall be maintained on all hooters and sirens, and the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other plant. .

No amplified music shall be allowed on site. The use of radios, tape recorders, compact disc players, television sets etc. shall not be permitted unless the volume is kept sufficiently low as to avoid any intrusion on members of the public within range. The Contractor shall not use sound amplification equipment on Site unless in emergency situations.

10.7 Hazardous materials control

All relevant national, regional and local legislation with regard to the transport, use and disposal of hazardous materials shall be strictly complied with. The contractor shall obtain the advice of the manufacturer (Material Data Sheets) with regard to the safe handling of hazardous materials.

The contractor shall ensure that there is an emergency procedure in place to deal with accidents and incidents (e.g. spills) arising from hazardous substances.

The contractor shall ensure that all personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances.

The contractor shall report incidents to the ECO immediately. Any spill incidents shall be cleaned up immediately in according with the emergency procedure.

The contractor shall supply the ECO with a list of all hazardous materials that would be present on site during the construction period. The same applies to any sub-contractor who shall provide the contractor with this information.

10.8 Blasting control

Any blasting required on site shall only occur during official working hours. Blasting shall only be undertaken where absolutely necessary.

In the event that excessive blasting is required the contractor shall ensure that potential claims from neighbouring properties in respect of damages to houses, towers and bridges (cracked walls, etc.) are valid. It is recommended that a survey be conducted to determine the pre-blasting condition of all houses in the area that could be affected by blasting activities.

The contractor shall distribute a list of dates (and times) during which blasting shall occur on site as well as place notices in appropriate areas. This shall ensure that the immediate surrounding residents are aware of the timing of blasting and thus would be in a position to prepare for the event. Emergency services shall be notified in

writing, a minimum of 24 hours prior to blasting taking place. In the event that deviations from the original planned dates are perceived, the contractor shall notify the surrounding residents well in advance (a minimum of 24 hours).

Blasting activities shall only occur under controlled conditions, whereby safety precautions are adhered to, and only authorised personnel may take part in these activities. The contractor shall inform all construction workers of dates and times when blasting will take place and the necessary safety steps shall be taken to prevent any injuries.

11 EFFLUENT AND STORMWATER MANAGEMENT

11.1 Introduction

Any effluent flowing out from the site shall be free from any pollution hazard, as this waste will invariably enter the surrounding environment. Section 10.2 and 10.4 outlines the procedures to follow in order to ensure that pollution and/or erosion resulting from construction activities do not result in damage to the surrounding areas.

All pipelines used on site shall be constructed of suitable materials such as wheolite, which reduces the risk of cracking from soil movements.

11.2 Storm water

Natural (storm water) runoff shall be diverted away from the construction area towards the storm water drains or channels. In addition, it shall be ensured that storm water is not allowed to collect to form ponds or excessively muddy conditions.

Special care shall be taken in areas susceptible to erosion, e.g. steep slopes. The contractor shall ensure that excessive quantities of sand, silt and silt-laden water do not enter the storm water system. Design of the storm water drainage system so as not to contaminate the natural drainage system is important. Appropriate measures, e.g. erection of silt traps, or drainage retention areas, to prevent silt and sand entering drainage lines or watercourses shall be taken.

The contractor shall clear any partial or complete blockage of the storm water drainage system as a result of construction activities at his own expense.

11.3 Discharge of construction water (effluent)

The contractor shall ensure that polluted runoff (excluding silt pollution) such as runoff from the construction camp where equipment is cleaned and/or serviced, is not discharged overland. Such runoff shall be directed into the local sewer main or suitable alternative agreed upon with the local authority.

Silt-laden water may be disposed overland. This water may be allowed to filter into the ground provided that this action does not cause a pollution or erosion threat.

Water from washing concrete-mixing equipment (mixers and the like) shall not be discharged overland. As describe in Section 11.2 above, such water shall be collected (possibly in conservatory tank) and removed from the site and disposed of at a registered waste disposal site. It is suggested that such water be reused for washing other concrete-mixing equipment to minimise the amount of wastewater requiring removal from site.

Trucks delivering concrete shall not be washed or rinse their chutes on the site.

12 SITE REHABILITATION

All working areas shall be rehabilitated once work has been completed and before the team leaves the site. This includes closure and rehabilitation of temporary access routes. All foreign material not utilised in the rehabilitation activities shall be removed from the site. Re-vegetation of all exposed soil shall be done before the team leaves the site. Any potential erosion risks shall be addressed before the team leaves the site

Any areas that the Engineer believes may have been impacted upon or disturbed, shall be rehabilitated to the satisfaction of the Engineer, which includes all areas where Top material has been stripped. Once construction is complete the Contractor shall clear everything from the Site not forming part of the Permanent Works. The area to be rehabilitated shall first be landscaped to match the topography of the surrounding area as it was prior to construction. The composition of vegetation to be used for any rehabilitation shall be as specified in Section 5.12.

The Contractor shall not use herbicides, pesticides, fertilisers or other poisonous substances for the rehabilitation process unless otherwise agreed with the Engineer.

All rehabilitated areas shall be considered “no go” areas and the Contractor shall ensure that none of his staff or equipment enters these areas.

The Contractor shall undertake to remove all alien vegetation re-establishing on the area and shall implement the necessary temporary or permanent measures to combat soil erosion.

12.1 Removal of materials

After construction, any area cleared or disturbed (as a result of the activity) within and outside the boundaries of the construction site shall be rehabilitated to a state as agreed by the DEA and according to the specifications of the ECO.

All construction equipment and excess aggregate, gravel, stone, concrete, bricks, temporary fencing and the like shall be removed from the site upon completion of the work. No discarded materials of any nature shall be buried on the site, or on any vacant or open land in the area and shall only be disposed of at the appropriate registered waste disposal site.

12.2 Control of alien vegetation

Where project activities include the eradication of invasive alien plants, Working for Water guidelines and policies shall be adhered to. Any invasive alien plant clearing undertaken through Working for Wetlands projects shall be registered on the Working for Water Information Management System.

12.3 Landscaping and preparation for planting

Topmaterial that is disturbed or removed during construction and excavation shall be replaced, preferably using topsoil stockpiled prior to excavation activities, or with topsoil sourced from another reputable source. However, where possible, soils from different areas should not be mixed. Care shall be taken not to mix the topsoil with the subsoil during shaping operations.

Indigenous plants shall be used in the landscaping of the site. Plants that are proclaimed as problem plants or noxious weeds are to be excluded from the landscaping plan and these should be removed immediately, should they occur on site.

Species recommended for landscaping of the public areas include:

Trees and shrubs:

- *Buddleja saligna* (False olive)
- *Buddleja salviifolia* (Sagewood)
- *Celtis africana* (White stinkwood)
- *Diospyros lycoides* (Bluebush)
- *Dombeya rotundifolia* (Wild pear)
- *Gymnosporia buxifolia* (Common spike-thorn)
- *Olea europaea* (Wild olive)
- *Rhus lancea* (Karee)
- *Rhus leptodictya* (Mountain Karee)

Bulbs and forbs

- *Agapanthus* species (Agapanthus)
- *Albuca* species
- *Barleria obtusa*
- *Ceratotheca triloba* (Wild foxglove)
- *Chlorophytum* species
- *Crinum species* (Orange River Lily/Graslelie)
- *Felicia muricata*
- *Gazania krebsiana* (Botterblom)
- *Gerbera* species (Barberton Daisy)
- *Leonotis* species (Wild dagga)
- *Nemesia* species
- *Trachyandra* species
- *Watsonia* species (Watsonia)

The relevant landscaping contractors and excavation contractor shall be in consultation with each other and the ECO so as to prevent misunderstandings and therefore prevent potential negative environmental impacts.

An ecological approach to landscaping is recommended. Plants introduced into the project sites shall be guided by ecological rather than horticultural principles. For example ecological communities of indigenous plants provide more biodiversity and habitat opportunities and would blend with natural vegetation. This approach is also less costly to maintain and is sustainable in the long term.

13 EMERGENCY PROCEDURES

13.1 Introduction

The contractor shall ensure that all emergency procedures are in place prior to commencing work. Emergency procedures shall include, but are not limited to, fire, spills, contamination of the ground, accidents to employees, use of hazardous substances and materials, etc.

The contractor shall ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant and visible locations throughout the duration of the construction period.

13.2 Fire

The contractor shall take all reasonable measures to ensure that fires are not started as a result of construction activities on site, and shall also ensure that their operations comply with the Occupational Health and Safety Act (Act No. 85 of 1993). Open fires shall not be allowed on work sites and no exceptions should be made.

Basic functional fire fighting equipment shall be made available at each work site (1 back pack and at least 5 beaters), in forestry areas there must be 2 rake hoes per team.

Where fuels and machines are used on site, the prescribed fire extinguishers in working condition will be available.

Sparks generated during welding, cutting of metal or gas cutting can result in fires. Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion. Such precautions shall include having an approved fire extinguisher immediately available at the site of any such activities. The contractor shall ensure that there is basic fire fighting equipment available on site at all times. The contractor shall appoint a member of his staff to be responsible for the installation and inspection of this equipment. The contractor shall ensure that he/she has the contact details of the nearest fire station in case of an emergency.

Where projects fall within fire protection areas, the following will be applicable:

- The project will form part of the local Fire Protection Association
- The Project Manager will attend all FPA meetings
- The project will form part of the local FPA notification of the daily FOI (Fire Danger Index)
- In case of a red classification warning for the day extreme caution shall be applied.
- As soon as the actual FOI reaches a red classification all teams shall be withdrawn from affected areas.

13.3 Accidental leaks and spillages

The Contractor shall ensure that his employees are aware of the emergency procedure(s) to be followed for dealing with spills and leaks, which shall include notifying the Engineer and the relevant authorities. The Contractor shall ensure that the necessary materials and equipment for dealing with spills and leaks is available on Site at all times. Treatment and remediation of the spill areas shall be undertaken to the reasonable satisfaction of the Engineer.

In the event of a hydrocarbon spill, the source of the spillage shall be isolated, and the spillage contained. The area shall be cordoned off and secured. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/ breakdown and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill.

13.4 Safety

The contractor must ensure:

- Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993);
- That reasonable measures are taken to ensure the safety of all site staff;
- That all construction vehicles using public roads are in a roadworthy condition, that drivers adhere to the speed limits, that loads are secured and that all local, provincial and national regulations are adhered to; and
- That all accidents and incidents are recorded and reported to the ECO.

The contractor is to ensure that he/she has the contact details of the nearest emergency rooms (hospitals) to the site, of both private and public hospitals.

13.5 Communication

13.5.1 Community relations

The Contractor shall, during site establishment, erect and maintain information boards in the position, quantity, design and dimensions specified. Such boards shall include contact details for complaints by members of the public in accordance with details provided by the Engineer.

The Contractor shall keep a "Complaints Register" on Site. The Register shall contain all contact details of the person who made the complaint, and information regarding the complaint itself.

13.5.2 Implementers forum

A representative from each implementer is required to attend quarterly meetings of the implementers' forum. The purpose of these meetings is to share information, develop links between projects and enhance communication between Working for Wetlands and its implementers. Venues for these meetings will rotate between projects. A national health and safety meeting will form part of this forum.

13.5.3 Working for Wetlands logo

Working for Wetlands encourages its implementers to use the programme's logo in promoting the programme and wetland conservation and sustainable use in general. However, written permission shall be obtained from the programme manager before the logo is used on anything other than the prescribed signage or workers' t-shirts.

13.5.4 Signage

Each project shall erect at least one gate board per property on which work is done and one billboard in a prominent position. The basic designs for this signage will be those prescribed by Working for Wetlands, with provision for the addition of project-specific information.

13.6 Hazard identification and risk assessment (HIRA)

In terms of the OHS Act, the HIRA document shall be available on site and be understood by every manager and contractor. An emergency evacuation plan shall be available for each work site.

13.7 Erosion and sedimentation control

As stipulated in Section 10.4 the Contractor shall take all reasonable measures to limit erosion and sedimentation due to the construction activities. Where erosion and/or sedimentation, whether on or off the site, occurs despite the Contractor complying with the foregoing, rectification shall be carried out in accordance with details specified by the Engineer. Where erosion and/or sedimentation occur due to the fault of the Contractor, rectification shall be carried out to the reasonable requirements of the Engineer.

Any runnels or erosion channels developed during construction or during the defects liability period shall be backfilled and compacted. Stabilisation of cleared areas to prevent and control erosion shall be actively managed. Consideration and provision shall be made for various methods, namely, brushcut packing, mulch or chip cover, straw stabilising (at a rate of one bale/ 20 m^2 and rotovated into the top 100 mm of the completed earthworks), watering, soil binders and anti-erosion compounds, mechanical cover or packing structures (e.g. Hessian cover).

Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised area shall be repaired and maintained to the satisfaction of the Engineer.

14 SOCIAL DEVELOPMENT

14.1 Primary health

An HIV / Aids information session will be held with each team in conjunction with an approved institution at least once every six months. There will be a minimum of one HIV / Aids peer educator per team.

Measures aimed at reducing the spread of HIV / Aids, including condoms, literature and posters, should be available to all workers.

Access of workers to local clinics should be facilitated wherever possible. Training will, where possible, include other aspects of primary health, including nutrition, reproductive health and hygiene,

14.2 World wetlands day

World Wetlands Day should be celebrated in an appropriate way by each implementer and include all project personnel

14.3 Open day

Each project will hold at least one open day per year, targeting surrounding communities, stakeholders and project partners

14.4 Active employee and contractor participation in project management

Workers will have a formalised forum through which they can make inputs into the overall management of the project (e.g. a workplace committee).

14.5 Active forums for public participation in projects (Advisory Committees)

Each project shall have a functional advisory committee, based on the guidelines provided by Working for Wetlands. Where possible and appropriate these committees shall form part of existing Working for Water advisory committees. Advisory committees shall represent all communities from which workers are drawn and in which work is being done.

Meetings will be run according to the Working for Wetlands guidelines for advisory committees. Minutes of advisory committee meetings will be made available to Working for Wetlands on request

Advisory committees will assist in the identification of potential contractors and target groups for employment. Community-based forums should participate in advisory committees in order to contribute to the prioritisation and implementation of social development activities

15 MANAGEMENT AND MONITORING

This section focuses on the systems and procedures required to ensure that the environmental specifications contained in the CEMP are effectively implemented, monitored and recorded.

15.1 Location of the construction environmental management plan

All contractors on site shall at all times have a copy of the CEMP in their respective site office (located in the construction camp).

15.2 General monitoring and reporting

The ECO and contractors on site are responsible for ensuring compliance with the CEMP. Monthly site audits shall be undertaken by the ECO and a Project Inspection Report submitted to the SANBI for review prior to the following audit. Refer to Annexure B for the Project Inspection Report.

A Compliance Audit Report shall be submitted to the DEA collating the year's completed checklists. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified to the DEA.

Interested and Affected Parties must be allowed access to the CEMP document. They have the right to monitor specific aspects of the CEMP (e.g. noise regulations, working hours stipulated) in conjunction with the contractor in a reasonable and formal manner without unreasonably disrupting construction activities. However, no member of the public shall enter the building site without prior approval from the contractor.

The contractor shall keep a record of all complaints received from the community in a complaints register and communicate them to the ECO. These complaints shall be addressed and mitigated within reason. Records relating to the compliance/non-compliance with the conditions of the CEMP as well as audits reports, shall be kept in good order and shall be made available to the DEA within seven days after a written request has been

received. It is suggested that all records be kept for at least two years following construction activities for reference purposes.

1.1.1 Fixed-point photography

Monthly fixed-point photography monitoring information shall be undertaken by the project management for each problem site.

Locating photo-points

The following guidelines should be followed when locating photographic points across the wetland system for fixed-point photographs:

- photo-points should be selected at various locations throughout the rehabilitation site and at points that will be easily accessible at all times
- record the geographical co-ordinates of each point, with a mapping grade Global Positioning System (GPS), accurate to less than 2 metres. This provides any individual with the information required to navigate to the exact location of each photo point
- a permanent field marker must be placed in the ground at each point, to ensure that photos are always taken from exactly the same point. If possible the orientation of the photo at the point should be recorded on the marker

Fixed-point photographs

The following guidelines should be followed when implementing fixed-point photography for monitoring purposes:

- the orientation of the photographer should be recorded
- use the same camera, lens and zoom each time. If this is not possible, record the settings used. The camera should preferably be located on a tripod at a fixed height
- when the frequency of monitoring increases to an annual interval, photographs should be taken at roughly the same time of year and at the same time of the day, and under similar weather conditions. This would limit the variability of the wetland habitat associated with vegetative and hydrological changes linked to seasons
- a standard object, such as a soil auger or a metre rule should be included in the photograph as a reference for scale
- record relevant information about factors that may influence features in the photograph (e.g. a recent fire, late or early rains, etc.), especially those relating to the appearance of the site

15.3 Specific roles and responsibilities

The roles of the responsible people on site are included below:

The SANBI is the ultimate responsible party for the development and all aspects and phases thereof. The SANBI or an appointed representative shall communicate all issues raised in this CEMP with all personnel undertaking any work on the site. Should any non-compliance with this CEMP take place, SANBI shall ultimately be held liable. SANBI shall include the CEMP as a specific condition within any contract that is to be signed between him/her and any other party involved in the construction of the development. The SANBI is responsible for identifying which local / provincial environmental authority has jurisdiction over the project.

The Contractor is responsible for complying with the CEMP during the construction phase of the development. The Contractor is responsible for ensuring that his/her contractors, employees and sub-contractors appointed by

him/her are familiar with the CEMP and that they abide by it. The Contractor shall be responsible for any non-compliance with the CEMP and shall pay for any remedial work that may result from non-compliance resulting directly from his/her negligence.

The ECO is responsible for communicating environmental issues associated with the site to the Contractor. Should any non-compliance with the CEMP take place, the ECO shall communicate this with the party responsible for the non-compliance as well as the Contractor and the SANBI. If the non-compliance continues after written request by the ECO to rectify the situation, the ECO must inform the DEA in writing. The ECO is responsible for the explanation of environmental issues contained in this CEMP to anyone working on the site. Should any issues arise on the site of an environmental nature or concern, the ECO shall be responsible for taking the appropriate action.

The Project Manager is responsible for communicating any issues or concerns of the surrounding community regarding the development to the SANBI PC or other responsible party and *visa-versa.*

The DEA is responsible for taking action against any non-compliance with the CEMP by the Contractor and or any of his/her subcontractors. The DEA may request a compliance audit to be undertaken on the site at any time during or after the construction phase of the project.

15.4 GUIDELINES

The following guidelines and recommended templates will be made available to all implementers:

1. Guidelines for completing Working for Wetlands business plans and project implementation plans
2. Working for Wetlands risk assessment framework
3. Project management tools:
    - Daily attendance register
    - Vehic1e check sheet
    - Production sheet
    - Project manager's inspection sheet
    - Implementer's inspection sheet
    - Incident report for near misses
    - Format for toolbox talk minutes
    - Receipt of goods
    - Consumables used sheet
    - Pay sheet
    - Personnel update sheet
    - Contractor's invoice
    - Filing of information
    - Safety plan and emergency numbers
    - Tender document
    - Contractor safety policy
    - Risk assessment

- Registration form for Compensation for Occupational Injuries and Diseases Act
- OHS Act notification of construction work
- Construction supervisor appointment letter
- Health and safety construction representative appointment letter
- First aid officer appointment letter
- First aid kit contents
- Training matrix
- Record of completed training
- Grievance procedure and grievance form
- PPE matrix
- Record of PPE issued
- Disciplinary procedure
- Contractor and worker contracts

Annexure A

BASIC CONDITIONS OF EMPLOYMENT ACT, 1997: CODE OF GOOD PRACTICE FOR EMPLOYMENT AND CONDITIONS OF WORK FOR SPECIAL PUBLIC WORKS PROGRAMMES

GOVERNMENT NOTICES

DEPARTMENT OF LABOUR

No. R. 63
25 January 2002

BASIC CONDITIONS OF EMPLOYMENT ACT, 1997: MINISTERIAL DETERMINATION SPECIAL PUBLIC WORKS PROGRAMMES

I, Membathisi Mphumzi Shepherd Mdladlana, Minister of Labour, hereby in teens of section 50 of the Basic Conditions of Employment Act, 1997, make a Ministerial Determination establishing conditions of employment for employees in Special Public Works Programmes, South Africa, in the Schedule hereto and determine the second Monday after the date of publication of this notice as the date from which the provisions of the said Ministerial Determination shall become binding.

M.M.S. MDLADLANA
Minister of Labour

SCHEDULE

MINISTERIAL DETERMINATION NO: 3: SPECIAL PUBLIC WORKS PROGRAMMES

Index

1. Definitions

1.1 In this determination -

"special public works programme" means a programme to provide public assets through a short-term, non-permanent, labour intensive programme initiated by government and funded from public resources.

1.2 Without limiting subsection (1), the following programmes constitute special public works programmes:

(a) Working for Water

(b) Community based public works

(c) Coastal Care

(d) Sustainable Rural Development (DPLG)

(e) Landcare

(f) Community Water & Sanitation

(g) Arts & Culture poverty relief projects

2. Application

This Determination applies to all employers and employees engaged in public works programmes.

3. The following provisions of the Basic Conditions of Employment Act do not apply to public works programmes -

3.1 Section 10(2)	**Overtime rate**
3.2 Section 11	**Compressed working week**
3.3 Section 14(3)	**Remuneration required for meal intervals of longer than 75 minutes**
3.4 Section 16	**Pay for work on Sundays**
3.5 Section 17(1) & (2)	**Payment of night shift allowance and supply of transportation**
3.6 Section 20	**Annual leave**
3.7 Section 21	**Pay for annual leave**
3.8 Section 22	**Sick leave**
3.9 Section 25(2) & (3)	**Commencement of maternity leave and return to work**
3.10 Section 26(2)	**Alternative work for pregnant women**
3.11 Section 27	**Family responsibility leave**
3.12 Section 29(h) to (p)	**Written particulars of employment**
3.13 Section 30	**Display of employee's rights**
3.14 Section 33(1)(g)	**Information about remuneration**
3.15 Section 34(1)(a)	**Deduction by individual agreement**
3.16 Section 34(2) & (3)	**Deduction of damages caused by employee**
3.17 Section 37	**Notice of termination**
3.18 Section 38	**Payment instead of notice**
3.19 Section 39	**Notice for employees in employer supplied accommodation**
3.20 Section 40	**Payments of outstanding amounts on**

termination

3.21 Section 41 **Severance pay**

3.22 Section 42(c) **Certificate of service**

3.23 Sections 51 - 58 **Sectoral Determinations**

3.24 Section 84 **Duration of employment**

4. Conditions

As set out in the ANNEXURE:

ANNEXURE

CONDITIONS OF EMPLOYMENT FOR SPECIAL PUBLIC WORKS PROGRAMMES

1. Introduction

1.1 This document contains the standard terms and conditions for workers employed in elementary occupations on a Special Public Works Programme (SPWP). These terms and conditions do NOT apply to persons employed in the supervision and management of a SPWP.

1.2 In this document -

(a) "department" means any department of the State, implementing agent or contractor;

(b) "employer" means any department, implementing agency-or contractor that hires workers to work in elementary occupations on a SPWP;

(c) "worker" means any person working in an elementary occupation on a SPWP;

(d) "elementary occupation" means any occupation involving unskilled or semi-skilled work;

(e) "management" means any person employed by a department or implementing agency to administer or execute an SPWP;

(f) "task" means a fixed quantity of work;

(g) "task-based work" means work in which a worker is paid a fixed rate for performing a task;

(h) "task-rated worker" means a worker paid- on the basis of the number of tasks completed;

(i) "time-rated worker" means a worker paid on the basis of the length of time worked.

2. Terms of Work

2.1 Workers on a SPWP are employed on a temporary basis:

2.2 A worker may NOT be employed for longer than 24 months in any five-year cycle on a SPWP.

2.3 Employment on a SPWP does not qualify as employment as a contributor for the purposes of the Unemployment Insurance Act 30 of 1966.

3. Normal Hours of Work

3.1 An employer may not set tasks or hours of work that require a worker to work

(a) more than forty hours in any week;

(b) on more than five days in any week; and

(c) for more than eight hours on any day.

3.2 An employer and worker may agree that a worker will work four days per week. The worker may then work up to ten hours per day.

3.3 A task-rated worker may not work more than a total of 55 hours in any week to complete the tasks allocated (based on a 40-hour week) to that worker.

4. Meal Breaks

4.1 A worker may not work for more than five hours without taking a meal break of at least thirty minutes duration.

4.2 An employer and worker may agree on longer meal breaks.

4.3 A worker may not work during a meal break. However, an employer may require a worker to perform duties during a meal break if those duties cannot be left unattended and cannot be performed by another worker. An employer must take reasonable steps to ensure that a worker is relieved of his or her duties during the meal break.

4.4 A worker is not entitled to payment for the period of a meal break. However, a worker who is paid on the basis of time worked must be paid if the worker is required to work or to be available for work during the meal break.

5. Special Conditions for Security Guards

5.1 A security guard may work up to 55 hours per week and up to eleven hours per day.

5.2 A security guard who works more than ten hours per day must have a meal break of at least one hour or two breaks of at least 30 minutes each.

6. Daily Rest Period

Every worker is entitled to a daily rest period of at least eight consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.

7. Weekly Rest Period

Every worker must have two days off every week. A worker may only work on their day off to perform work which must be done without delay and cannot be performed by workers during their ordinary hours of work ("emergency work").

8. Work on Sundays and Public Holidays

8.1 A worker may only work on a Sunday or public holiday to perform emergency or security work.

8.2 Work on Sundays is paid at the ordinary rate of pay.

8.3 A task-rated worker who works on a public holiday must be paid -

(a) the worker's daily task rate, if the worker works for less than four hours;

(b) double the worker's daily task rate, if the worker works for more than four hours.

8.4 A time-rated worker who works on a public holiday must be paid -

(a) the worker's daily rate of pay, if the worker works for less than four hours on the public holiday;

(b) double the worker's daily rate of pay, if the worker works for more than four hours on the public holiday.

9. Sick Leave

9.1 Only workers who work four or more days per week have the right to claim sick-pay in terms of this clause.

9.2 A worker who is unable to work on account of illness or injury is entitled to claim one day's paid sick leave for every full month that the worker has worked in terms of a contract.

9.3 A worker may accumulate a maximum of twelve days' sick leave in a year.

9.4 Accumulated sick-leave may not be transferred from one contract to another contract.

9.5 An employer must pay a task-rated worker the worker's daily task rate for a day's sick leave.

9.6 An employer must pay a time-rated worker the worker's daily rate of pay for a day's sick leave.

9.7 An employer must pay a worker sick pay on the worker's usual payday.

9.8 Before paying sick-pay, an employer may require a worker to produce a certificate stating that the worker was unable to work on account of sickness or injury if the worker is -

(a) absent from work for more than two consecutive days; or

(b) absent from work on more than two occasions in any eight-week period.

9.9 A medical certificate must be issued and signed by a medical practitioner, a qualified nurse or a clinic staff member authorised to issue medical certificates indicating the duration and reason for incapacity.

9.10 A worker is not entitled to paid sick-leave for a work-related injury or occupational disease for which the worker can claim compensation under the Compensation for Occupational Injuries and Diseases Act.

10. Maternity Leave

10.1 A worker may take up to four consecutive months' unpaid maternity leave.

10.2 A worker is not entitled to any payment or employment-related benefits during maternity leave.

10.3 A worker must give her employer reasonable notice of when she will start maternity leave and when she will return to work.

10.4 A worker is not required to take the full period of maternity leave. However, a worker may not work for four weeks before the expected date of birth of her child or for six weeks after the birth of her child, unless a medical practitioner, midwife or qualified nurse certifies that she is fit to do so.

10.5 A worker may begin maternity leave -

(a) four weeks before the expected date of birth; or

(b) on an earlier date

(i) if a medical practitioner, midwife or certified nurse certifies that it is necessary for the health of the worker or that of her unborn child; or

(ii) if agreed to between employer and worker; or

(c) on a later date, if a medical practitioner, midwife or certified

nurse has certified that the worker is able to continue to work without endangering her health.

10.6 A worker who has a miscarriage during the third trimester of pregnancy or bears a stillborn child may take maternity leave for up to six weeks after the miscarriage or stillbirth.

10.7 A worker who returns to work after maternity leave, has the right to start a new cycle of twenty-four months employment, unless the SPWP on which she was employed has ended.

11. Family responsibility leave

11.1 Workers, who work for at least four days per week, are entitled to three days paid family responsibility leave each year in the following circumstances -

(a) when the employee's child is born;

(b) when the employee's child is sick,

(c) in the event of a death of

(i) the employee's spouse or life partner;

(ii) the employee's parent, adoptive parent, grandparent, child, adopted child, grandchild or sibling.

12. Statement of Conditions

12.1 An employer must give a worker a statement containing the following details at the start of employment -

(a) the employer's name and address and the name of the SPWP;

(b) the tasks or job that the worker is to perform; and

(c) the period for which the worker is hired or, if this is not certain, the expected duration of the contract;

(d) the worker's rate of pay and how this is to be calculated;

(e) the training that the worker will receive during the SPWP.

12.2 An employer must ensure that these terms are explained in a suitable language to any employee who is unable to read the statement.

12.3 An employer must supply each worker with a copy of these conditions of employment.

13. Keeping Records

13.1 Every employer must keep a written record of at least the following -

(a) the worker's name and position;

(b) in the case of a task-rated worker, the number of tasks completed by the worker;

(c) in the case of a time-rated worker, the time worked by the worker;

(d) payments made to each worker.

13.2 The employer must keep this record for a period of at least three years after the completion of the SPWP.

14. Payment

14.1 An employer must pay all wages at least monthly in cash or by cheque or into a bank account.

14.2 A task-rated worker will only be paid for tasks that have been completed.

14.3 An employer must pay a task-rated worker within five weeks of the work being completed and the work having been approved by the manager or the contractor having submitted an invoice to the employer.

14.4 A time-rated worker will be paid at the end of each month.

14.5 Payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.

14.6 Payment in cash or by cheque must take place

(a) at the workplace or at a place agreed to by the worker;

(b) during the worker's working hours or within fifteen minutes of the start or finish of work,

(c) in a sealed envelope which becomes the property of the worker.

14.7 An employer must give a worker the following information in writing

(a) the period for which payment is made;

(b) the numbers of tasks completed or hours worked;

(c) the worker's earnings;

(d) any money deducted from the payment;

(e) the actual amount paid to the worker.

14.8 If the worker is paid. in cash or by cheque, this information must be recorded on the envelope and the worker must acknowledge receipt of

payment by signing for it.

14.9 If a worker's employment is terminated, the employer must pay all monies owing to that worker within one month of the termination of employment.

15. Deductions

15.1 An employer may not deduct money from a worker's payment unless the deduction is required in terms of a law.

15.2 An employer must deduct and pay to the SA Revenue Services any income tax that the worker is required to pay.

15.3 An employer who deducts money from a worker's-pay for payment to another person must pay the money to that person within the time period and other requirements specified in the-agreement law, court order or arbitration award concerned.

15.4 An employer may not require or allow a worker to -

(a) repay any payment except an overpayment previously made by the employer by mistake:

(b) state that the worker received a greater amount of money than the employer actually paid to the worker; or

(c) pay the employer or any-other person for having been employed.

16. Health and Safety

16.1 Employers must take all reasonable steps to ensure that the working environment Is healthy and safe.

16.2 A worker must -

(a) work in a way that does not endanger his/her health and safety or that of any other person;

(b) obey any health and safety instruction;

(c) obey all health and safety rules of the SPWP;

(d) use any personal protective equipment or clothing issued by the employer;

(e) report any accident, near-miss incident or dangerous behaviour by another person to their employer or manager.

17. Compensation for Injuries and Diseases

17.1 It is the responsibility of the employers (other than a contractor) to arrange for all persons employed on a SPWP to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130

of 1993.

17.2 A worker must report any work-related injury or occupational disease to their employer or manager.

17.3 The employer must report the accident or disease to the Compensation Commissioner.

17.4 An employer must pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer will be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

18. Termination

18.1 The employer may terminate the employment of a worker for good cause after following a fair procedure.

18.2 A worker will not receive severance pay on termination.

18.3 A worker is not required to give notice to terminate employment. However, a worker who wishes to resign should advise the employer in advance to allow the employer to find a replacement.

18.4 A worker who is absent for more than three consecutive days without informing the employer of an intention to return to work will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

18.5 A worker who does not attend required training events, without good reason, will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

19. Certificate of Service

19.1 On termination of employment, a worker is entitled to a certificate stating

(a) the worker's full name,

(b) the name and address of the employer;

(c) the SPWP on which the worker worked;

(d) the work performed by the worker;

(e) any training received by the worker as part of the SPWP;

(f) the period for which the worker worked on the SPWP;

(g) any other information agreed on by the employer and worker.

Annexure B

Project Inspection Report

Annexure B

Project Inspection Report

Project Inspection Report

Jump to: Project Contact Person Conducting Inspection Reference Forms Used People Spoken To Financial Checks Fixed Assets Registers Progress: Deliverables Project Management Health and Safety Environmental Management Risk Management General Key Inspection Dates Problems and Proposed Solutions Author Details

dd/mm/yyyy

Valid date of report:

Project Manager	SANBI Ref No	
Project	Project Inspection Report	1

Project Name

Project Period / Description

System Ref No:

Estimated Duration

	dd/mm/yyyy		dd/mm/yyyy		
Start Date		Completion Date		Estimated Duration:	

Note:*This Period will be used to generate the Cash Flow.*

Project Description (What are you going to do)

Project Group (Office Use Only)

Main Wetland

Province

District Municipality
Local Municipality

Wetland Name	Indicate if this wetland was visited during this inspection (Y/N)

Project Contact

PROJECT MANAGER			
Contact Organization			
Contact Person			
Title: Surname:		Initials:	Position

PM Organization Address			
Physical Address		**Postal Address** (if different from Physical)	
Email Address		Fax	
		Tel (Office)	

PM Person's Address			
Physical Address		**Postal Address** (if different from Physical)	
Email Address		Fax	
Cellular		Tel (Office)	

Person Conducting Inspection

Name and Contact			
Department / Firm / Organisation			
Contact Person			
Title: Surname:		Initials:	Position

Address			
Email Address			
Cellular		Tel (Office)	

Reference Forms Used

Date of Project Implementation Plan used	
Date	

Date of Project Progress Report used	
Date	

Remember to take copies of e.g. Business Plan, Cash Flow / Expenditure reports, Procurement procedures, previous Inspection Report

People Spoken To

List people spoken to, contact details and subjects discussed

Financial Checks

Is the expenditure according to cash flow?	Y/N	
Does the expenditure seem in line with milestones reached?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		

Fixed Assets

Are there or will there be fixed assets on this project?	Y/N	
Is the asset register available?	Yes / No / N/A	
Are assets registered in the name of the owning agency?	Yes / No / N/A	
Are assets kept safely when not in use?	Yes / No / N/A	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		

Registers

a. Wage Registers		
Does the project keep a wage register, worker's timesheets and proof of payment?	Y/N	
Are the wage registers, worker's timesheets and proof of payments up to date?	Y/N	
Are they keeping track of Women/Youth/Disabled/Local?	Y/N	
Are the workers present reflected in today's register?	Y/N	
What is the total person-days reflected in the Wage Register?		
Person-days		
What is the minimum daily wage reflected in the Wage Register?		
Minimum daily wage		
Does this information tally with the Progress Report?	Y/N	
Does expenditure on wages correspond with the number of person days reported?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		
b. Training Registers		
Does the project have a Training Register?	Y/N	

Is the Training Register up to date?	Y/N	
Does this information tally with the Progress Report?	Y/N	
Have induction, H&S and first aid training been completed?	Y/N	
Does expenditure on training correspond with the no. of training days reported?	Y/N	
Comment on Training (including accreditation)		
Comment		
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		
c. SMME		
Are they keeping records of SMME's used?	Y/N	
How many SMME's are on record?		
Number of SMMEs on record		
How many SMME's are being used at present?		
Number currently being used		
Does this information tally with the Progress Report?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		

Progress: Deliverables

"In Compliance" means "Are the Deliverables in Compliance with the Rehabilitation Plan?"

Deliverable	Intervention Number	Description	% Complete	In Compliance Y/N

Is progress against Deliverables OK?	Y/N	
Do deliverables reported in the Project Progress Report correspond with actuals?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		

Project Management

a. Project Advisory Committee		
Is there a formally constituted and active Project Advisory Committee?	Y/N	
What was the date of the last meeting of the Project Advisory Committee? dd/mm/yyyy		
Does composition of PAC comply with Best Management Practices?	Y/N	
Are there proper minutes of Project Advisory Committee meetings?	Y/N	

If response is no, describe actions to ensure compliance (within 14 days)
Comment

b. Project Implementation Plan

Is the project achieving the intent of the Project Implementation Plan?	Y/N	

Are monthly Progress and Financial Reports being submitted? If not, why not?	Y/N	

If response is no, describe actions to ensure compliance (within 14 days)
Comment

c. Communication and Marketing

Has communication with other stakeholders happened?
Comment

Is signage in place?	Is signage in place?	

If response is no, describe actions to ensure compliance (within 14 days)
Comment

Health and Safety

Is there a First Aid box present?	Y/N	

Is there a First Aid person present?	Y/N	
Are workers wearing the required personal protective equipment?	Y/N	
Are records of near misses / incidents kept?	Y/N	
Are there proper minutes of H & S meetings?	Y/N	
Are Toolbox Talks happening?	Y/N	
General comment on Health and Safety Comment		
Are workers wearing Working for Wetlands t-shirts?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		

Environmental Management

Has an environmental training course in compliance with the CEMP been undertaken within seven days of the commencement date of construction?	Y/N	
When:		
As part of site establishment, has the working area been clearly defined with danger tape or other clearly visible markers?	Y/N	
Has the topsoil (up to 30 cm) been cleared from site and stored separately? If not, why?	Y/N	
Comment:		
Are no-go areas being adhered to?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		
If the wetland is a peat wetland, are the specific requirements pertaining to working within peat areas being implemented and enforced?	Y/N/ N/A	
If response is no, describe actions to ensure compliance:		
Comment		

Does the project have effective sanitation arrangements?	Y/N
If response is no, describe actions to ensure compliance:	
Comment	
Have the following issues been addressed in compliance with the CEMP?	
• Contractor's camp in compliance with the site plan?	Y/N
• All stores and materials stockpiled adequately/ secured?	Y/N
• Waste Bins and other waste storage receptacles in place?	Y/N

• Fuel storage and management?	Y/N
• Hazardous material management?	Y/N
• Dust management?	Y/N
• Stormwater and erosion protection?	Y/N
• Batching facilities lined and runoff contained?	Y/N

Is on-site rehabilitation effective?	Y/N	

If response is no, describe actions to ensure compliance (within 14 days)		
Comment		
Has revegetation been undertaken, especially in exposed and unstable areas?	Y/N	
If response is no, describe actions to ensure compliance:		
General comments on environmental management and CEMP compliance:		
Comment		

Risk Management

Is fire fighting equipment present and in working order?	Y/N	
Are there adequate facilities for storage of materials and equipment?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days)		
Comment		

General

a. Transport		
How many contractor's vehicles are there on site?	Number	
How many project vehicles are there on site?	Number	
Do vehicles comply with the Best Management Practices standards and CEMP requirements?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		

b. Comments		
Does the Quality of Work appear acceptable? Substantiate your answer	Y/N	
Is the work in compliance with Best Management Practices?	Y/N	
If response is no, describe actions to ensure compliance (within 14 days) Comment		

Key Inspection Dates

Effective Date of this Inspection	
Effective Date	

Target Date for next Inspection	
Target Date (dd/mm/yy)	

Problems and Proposed Solutions

Categories: Financial Checks, Assets, Progress, Special Conditions, Management, General

Problem and Proposed Solution	Category	Initial Target Date	Revised / Actual Date	% Progress

Please take photos and email to HO with date, location and title

Author Details

Person completing this form

Department / Firm / Organization

Contact Person

Title: Surname: Initials: Position

Address			
Email Address		Fax	
Cellular		Tel (Office)	

APPENDIX G – NATIONAL STAKEHOLDERS

TITLE	INITIAL/NAME	SURNAME	ORGANISATION
NATIONAL			
Ms	Jackie	Jay	Department of Water Affairs
Mr	David	Kleyn	Department of Agriculture Forestry & Fisheries
Mr	Christo	Marais	Department of Water Affairs
Ms	Kerryn	Morrison	Endangered Wildlife Trust
Ms	Naomi	Fourie	Department of Water Affairs
Ms	Valerie	du Plessis	Department of Water Affairs
Mr	Guy	Preston	Department of Water Affairs
Ms	Fulufhelo	Mafelatshuma	Department of Water Affairs : RQS
Ms	Wilma	Lutsch	Department of Environmental Affairs
Mr	Bonani	Madikizela	Water Research Commission
Mr	Tambubzani	Mulaudzi	Department of Environmental Affairs: Directorate: Sensitive Environments
Ms	Linda	Poll-Jonker	Department of Environmental Affairs

APPENDIX H – PROVINCIAL STAKEHOLDERS

Mpumalanga IBAR DatabaseP Database
November 2012

TITLE	INITIAL/NAME	SURNAME	ORGANISATION
NATIONAL AUTHORITIES			
Ms	Jackie	Jay	Department of Water Affairs
Mr	David	Kleyn	Department of Agriculture Forestry & Fisheries
Mr	Christo	Marais	Department of Water Affairs
Ms	Kerryn	Morrison	Endangered Wildlife Trust
Ms	Naomi	Fourie	Department of Water Affairs
Ms	Valerie	du Plessis	Department of Water Affairs
Mr	Guy	Preston	Department of Water Affairs
Ms	Fulufhelo	Mafelatshuma	Department of Water Affairs : RQS
Ms	Wilma	Lutsch	Department of Environmental Affairs
Mr	Bonani	Madikizela	Water Research Commission
Mr	Tambubzani	Mulaudzi	Department of Environmental Affairs: Directorate: Sensitive Environments
Ms	Linda	Poll-Jonker	Department of Environmental Affairs
PROVINCIAL AUTHORITIES			
Mr	Gavin	Cowden	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Mr	Jannsen	Davies	Mpumalanga Tourism & Parks Agency (MTPA)
Dr	Almari	de Lange	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Ms	Mbali Marcia	Dlamini	Department Agriculture Forestry and Fisheries (DAFF)
Mrs	Valerie	Du Plessis	Department Agriculture Forestry and Fisheries (DAFF)
Mr	Martin	Fuwela	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Mr	Hein	Geldenhuys	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Mrs	Marina	Geldenhuys	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Mr	Richard	Green	Department Agriculture Forestry and Fisheries (DAFF)
Ms	Tania	Henning	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Mr	Brian	Jackson	Inkomati Catchment Management Agency (ICMA)
Mr	Sampie	Shabangu	DWA: Licensing
Mr	Themba	Khoza	Department Agriculture Forestry and Fisheries (DAFF)
Mr	David	Kleyn	Department Agriculture Forestry and Fisheries (DAFF)
Mr	Frans	Krige	Mpumalanga Tourism and Parks Agency (MTPA)
	Louis	Loock	Mpumalanga Tourism and Parks Agency (MTPA)
Mr	Altus	Lotter	MDEDET
Mr	Surgeon	Marebane	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
	Selby	Lukhele	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Mrs	Robyn	Beeching	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
	Buyi	Mabaso	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Ms	Pheko	Mabena	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Mr	Stanford	Macevele	Department of Water Affairs (DWA)
Ms	Busi	Mahlangu	Department of Water Affairs (DWA)
Ms	Andiswa	Makam	Department of Water Affairs (DWA)
	Tshepiso	Makola	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Mr	Hannes	Marais	Mpumalanga Tourism and Parks Agency (MTPA)
Mr	Frans	Mashabela	Department Agriculture Forestry and Fisheries (DAFF)
	Kurisani	Mashava	Department of Water Affairs (DWA)
Mr	Kenneth	Mavhunga	Department of Agriculture, Forestry and Fisheries (DAFF)
Mr	Paul	Meulenbeld	DWA: Gauteng S Water Quality
	Bheki	Mndawe	Mpumalanga Department of Economic Development Environment & Tourism (MDEDET)
Ms	Mary	Mogale	Department of Agriculture, Forestry & Fisheries (DAFF)
	Shobate	Mohlahlana	Department Agriculture Forestry and Fisheries (DAFF) : Landcare Programme
Mr	Brian	Morris	Mpumalanga Tourism and Parks Agency (MTPA)
	Nocawe	Mthombothi	DEDET
Miss	Ronell	Niemand	Mpumalanga Tourism and Parks Agency (MTPA)
Mr	Thya	Pather	DWA
	Love	Shabane	DAFF
	Rhandzu	Shivambu	Mpumalanga Department of Agriculture, Rural Development & Land Administration (MDARD
Ms	Lynette Sibongil	Van Damme	SAHRA
	Dan'sile	Cindi	Dept. Agriculture, Forestry & Fisheries - LUSM
Mr	Hennie	Laas	Mpumalanga Landbou / Agriculture
Mr	Johann	Van Aswegen	Department Agriculture Forestry and Fisheries (DAFF)

Mpumalanga IBAR DatabaseP Database
November 2012

TITLE	INITIAL/NAME	SURNAME	ORGANISATION
LANDOWNERS			
Ms	Rosmarie	Hinze	Farm 134 (Goedgevonden)
	Mpumalanga Tourism and Parks Ag		Farm 101 (Paardeplaats)
Mr	JH	Klingenberg	Farm 101 (Paardeplaats)
			Farm 121
WORKING FOR WETLANDS			
Ms	Nonzukiso	Mbona	SANBI
Mr	André	Beetge	SANBI: WfWet Provincial Coordinator
Mr	Umesh	Bahadur	South African National Biodiversity Institute
Ms	Anika	Govender	South African National Biodiversity Institute
Mr	Don	Cater	Eastern Wetland Rehabilitation
Mr	Stefan	Kruger	Eastern Wetland Rehabilitation
MUNICIPALITIES			
Mr	Johan	Du Plooy	Gert Sibande District Municipality
Mr	Dan	Hlanyane	Gert Sibande District Municipality
Mr	Leon	Grové	Pixley ka Seme Local Municipality
Ms	Kittie	Haupht	Pixley ka Seme Local Municipality
Mr	SN	Ndhlela	Pixley ka Seme Local Municipality
Mr	Stiaan	Van de Linde	Pixley ka Seme Local Municipality
WETLAND FORUM/OTHER			
Ms	Carolyn	Ah Shene-Verdoorn	Birdlife South Africa
Mr	Mark	Anderson	Birdlife South Africa
Miss	Esther	Appleyard	Eskom Holdings Limited
Mr	Lemson	Betha	Wildlife and Environment Society of SA (WESSA) - Gauteng
Mr	Greg	Beyers	Ajubatus Environmental Management (Pty) Ltd
Dr	Harry	Biggs	SANParks
Mr	Anton	Bothma	Eastern Wetland Rehabilitation (EWR)
Mr	Jan	Brink	Working For Water (W4W)
Mr	Angus	Burns	Enkangala Grasslands Project (EGT)
	Jannie	Coetsee	Regional Ecologist MTAP
Mr	Brent	Corcoran	WWF
Mr	Mandla	Dladla	Birdlife South Africa
	Adele	Drake	York Timbers
Mr	Derick	du Toit	Association for Water and Rural Development (AWARD)
Mr	Tony	Ferrar	Wildlife & Environment Society of South Africa (WESSA) - Lowveld
Mr	Chris	Foster	Komatiland Forests (KLF)
Miss	Ursula	Franke	Endangered Wildlife Trust (EWT) - SACWG (South African Crane Working Group)
Mr	David	Gaynor	Dullstroom Ratepayers Association
Mr	Peta	Hardy	Sappi Forests
Clr	James	Harris	Councillor (Govan Mbeki Local Municipality) / Olifants River Forum
Mr	Norman	Hayton	Friends of Witbank Nature Reserve
	Diketso	Khaile	Inkomati Catchment Management Agency (ICMA)
Ms	Thandeka	Khumalo	Endangered Wildlife Trust (EWT)
Mr	Vaughan	Koopman	Mondi Wetlands Project
Mr	Stefan	Kruger	Eastern Wetland Rehabilitation (EWR)
Mr	David	Lindley	Mondi Wetlands Project
Mr	Anton	Linström	Wet earth Eco-Specs (formerly with Mpumalanga Parks & Tourism Agency)
Ms	Eva	Lubede	Inkomati Catchment Management Agency
Ms	Sylvia	Machimana	Inkomati Catchment Management Agency
Mr	John	Magamezulu	Inkomati Catchment Management Agency
Mr	Patrick	Makwakwa	Inkomati Catchment Management Agency (ICMA)
Mr	Dave	Malloch-Brown	York Timbers
Mr	Daniel	Marnewick	Birdlife South Africa
	Pat	Martinson	Wildlife and Environment Society of SA / Friends of Witbank Nature Reserve
	Bekky	Mashego	Komatiland Forests (KLF)
	Bongani Vincent	Mashele	South African National Biodiversity Institute (SANBI)
	Nikki	McCartney	Birdlife South Africa
Ms	Kerryn	Morrison	International Crane Foundation / Endangered Wildife Trust Partnership
	Tsumbedzo	Mudalahothe	Sanbi-Grassland Programme
Mr	Sizile	Ndlovu	Inkomati Catchment Management Agency

Mpumalanga IBAR DatabaseP Database
November 2012

TITLE	INITIAL/NAME	SURNAME	ORGANISATION
	Xolani	Ngobeza	Birdlife South Africa
	Penny	Pistorius	WESSA Lowveld (Volunteer)
	Leigh	Potter	Endangered Wildlife Trust (EWT) - Threatened Grassland Species Programme
Ms	Glenn	Ramke	Endangered Wildlife Trust (EWT) - SACWG (South African Crane Working Group)
Mr	Marcus	Selepe	Inkomati Catchment Management Agency (ICMA)
Dr	Hanneline	Smit	Birdlife South Africa
Mr	Marius	Snyders	SANParks
Mr	Athol	Stark	Grass and Wetlands & Highveld Tourism
	Andre	Steenkamp	Birdlife SA - Wakkerstroom
Dr	Llew	Taylor	Taylor Environmental
Ms	Michelle	van der Merwe	Wetland Alliance for Training, Education and Research (WATER) (a project of WESSA)
Mr	Andre	van Tonder	Sappi Forests
	Elmien	Webb	Xstrata Coal South Africa
	Kim	Webb	WESSA
Mr	Ronald	Nenugwi	Working For Water (W4W)
Ms	Daleen	Strydom	Working For Water (W4W)
Mr	Dumisani	Nxumalo	Inkomati Catchment Management Agency (NCMA)